

V.3400
User's Guide

Motorola
5000 Bradford Drive
Huntsville, AL 35805-1993

Doc No. 6 209 5400 02 014
November 1996
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FCC REQUIREMENTS

This equipment complies with FCC rules Part 68. Located on the equipment is the FCC Registration Number and Ringer Equivalence Number (REN). You must provide this information to the telephone company if requested.

The Registration Number and REN will be inscribed on the printed circuit board on insert cards or on a label attached to either the chassis bottom or metal end-plate on standalone or rack models. In any case the FCC requires these numbers be prominently displayed on an outside surface of the equipment.

The REN is used to determine the number of devices you may legally connect to your telephone line. In most areas, the sum of the REN of all devices connected to one line must not exceed five (5.0). You should contact your telephone company to determine the maximum REN for your calling area.

A variety of Universal Service Ordering Code telephone wall jacks are available for different types of devices or services. Please note that the USOC jack required for this unit is RJ11.

The telephone company may change technical operations or procedures affecting your equipment. You will be notified of changes in advance to give you ample time to maintain uninterrupted telephone service.

If you experience trouble with this telephone equipment, please contact

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for information on obtaining service or repairs. The telephone company may ask that you disconnect this equipment from the network until the problem has been resolved. If your equipment continues to disrupt the network the telephone company may temporarily disconnect service. If this occurs you will be informed of your right to file a complaint with the FCC.

This equipment may not be used on coin service provided by the telephone company. Connection to party lines is subject to state tariffs.

An FCC compliant telephone cord and modular plug are provided with this equipment, which is designed to connect to the telephone network or premises wiring using a compatible modular jack that is Part 68 complaint. See installation instructions for details.

WARNING

This equipment uses, generates, and can radiate radio frequency energy interfering with radio communications if not installed and used according to the instruction manual. It has been tested and complies with the limits for a Class A computing device according to FCC Rules, Part 15. Operation of this equipment in a residential area may cause interference. If it does, you must correct the cause of the interference.

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

SHIELDED CABLES

This product has been tested and complies with FCC limits for a Class A computing device. Testing was done with shielded computer cables. Using unshielded cables could cause your system to emit excess radio frequency, increasing the chance of interference. To comply with FCC regulations it is necessary to use shielded computer cables with your installation.

SPECIAL REQUIREMENTS FOR CANADA

Certain requirements exist for data communication products manufactured for use in Canada. Principle among these requirements is the application of the IC label as described below. However, certain data communication products do not require the IC label nor adherence to IC requirements. If this is the case the IC label will not be affixed to the units.

INDUSTRY CANADA (IC) REQUIREMENTS

IC labels are affixed to each unit sold in Canada. This label has the certification number for that particular unit. The numbers are different for each model.

The Industry Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational, and safety requirements. IC does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment. For their own protection users should ensure that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

CAUTION

Users should not attempt to make installation connections themselves, but should contact the appropriate electric inspection authority or electrician.

LOAD NUMBER

The Load Number (LN) assigned to each terminal device denotes the percentage of the total load to be connected to a telephone loop which is used by the device, to prevent overloading. The termination on a loop may consist of any combination of devices subject only to the requirement that the total of the Load Numbers of all the devices does not exceed 100.

CANADIAN EMISSION REQUIREMENTS

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

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Chapter 1

Introduction

GENERAL

The Motorola V.3400 series of modems are synchronous, asynchronous, and fax modems that can establish and maintain data communications or facsimile links between a computer at your location, and a remote computer, fax, or Data Terminal Equipment (DTE) located anywhere a standard or cellular telephone can reach. Data transmission can be over standard dial-up, private leased telephone lines, or wireless communication.

The V.3400 series of modems communicate at standard data rates up to 28800 bps with compatible modems connected to similarly equipped computers, computer services, and data bases. Advanced error control and data compression ensure data integrity and increase data throughput.

When used with a Class 1 Fax software package, the modem can exchange fax documents at data rates of up to 14400 bps with any Group 3 fax machine or PC with a fax modem.

A high level security feature allows secure operation of the modem both locally and remotely.

FEATURES

The modem is a flexible telecommunications tool that offers outstanding compatibility and the following standard features:

Data Mode

- Full-duplex operation on 2-wire public, 2-wire or 4-wire private telephone connections with 2-wire public automatic or manual backup
- 300, 1200, 2400, 4800, 7200, 9600, 12000, 14400, 16800, 19200, 21600, 24000, 26400, and 28800 bps DCE data rates

- Compatible with these standards:
 - CCITT V.34
 - CCITT V.33
 - CCITT V.32 bis
 - CCITT V.32
 - CCITT V.29
 - CCITT V.27
 - CCITT V.22 bis
 - CCITT V.22
 - CCITT V.21
 - CCITT V.13
 - Bell 212A
 - Bell 103
 - Plus a variety of software packages
- Synchronous operation at all DCE data rates, and asynchronous operation up to 115200 bps
- CCITT V.42 bis and MNP level 5 data compression
- CCITT V.42 and MNP 4 error control protocol
- LCD configuration and status for easy operation
- Front panel lockout
- Autodial and Autoanswer capability
- Autobaud DTE rate and character format selection
- AT command set
- V.25 bis autodialer
- Configuration memory
- Phone number storage
- Multiple levels of security with auto callback and password protection and up to 50 users
- Automatic speed matching to originating modem
- Remote configuration using command mode or LCD
- Built-in standard diagnostics for testing phone line quality and modems at each end
- 801 auto dial support

- Many user options to support a wide range of operating environments

Fax Mode

- Fax speeds to 14.4 kbps
- HDLC framing to allow T.30 Error Correction Mode
- Standard Class 1 interface conforms to EIA-578
- Group 3 compatibility: CCITT V.21 Channel 2, V.27 ter, V.29, V.17
- Autoanswer under software control
- Automatic fax/data detection

COMMUNICATIONS SOFTWARE

Because software directs the computer and modem to communicate with each other, you will need Mirror III (available from Motorola) or another communications software package for most data mode operations involving the modem. After installing the modem consult the software user's manual for information on the communications software, commands, and features. Software operating commands provide the operator with complete control of the modem.

For operation as a fax modem, a computer and a Class 1 fax software package are required. A fax connection cannot be established except with software control. You will need FaxTalk Plus (available from Motorola) or another Fax communication package.

DESCRIPTION

Functional

The V.3400 processes serial asynchronous data from a DTE at all standard rates from 300 bps to 115.2 kbps, and serial synchronous data at rates from 300 to 28.8 kbps. Transmission can be over either dial-up lines or either 2- or 4-wire leased lines. The maximum line speed is 28.8 kbps. Built-in test features can determine system performance and isolate faults in the data link. Operation and configuration are controlled by either the front panel LCD, the AT command set, or the V.25 bis command set.

Physical

The V.3400 has a 32 character LCD front panel with three pushbuttons for option selection (Figure 1-1).

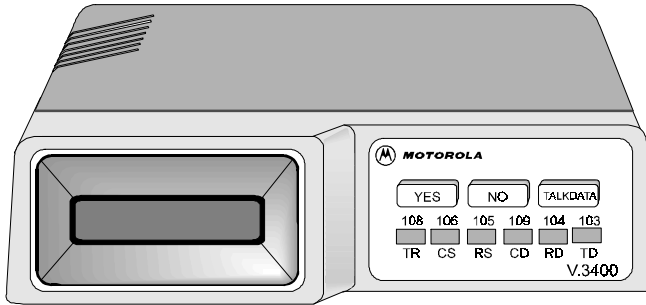


Figure 1-1 Typical Front Panel

The V.3400 rear panel has an EIA-232 DTE connector, an 8-pin AUX jack, an 8-pin LINE jack, the power switch, fuse, and cord (Figure 1-2).

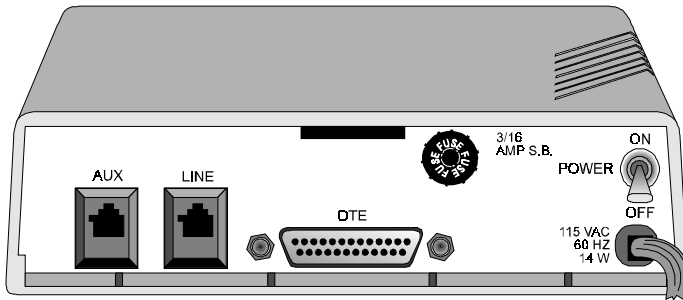


Figure 1-2 Rear Panel (115 Vac Model)

The shelf mount unit has edge connectors that insert into the shelf backplane. The shelf backplane performs the same functions as the standalone rear panel.

Chapter 2 Installation

GENERAL

This chapter provides information for the mechanical and electrical installation of the modem.

ELECTRICAL INSTALLATION

The rear panel (Figure 2-1) includes connectors for the DTE cable and telephone lines.

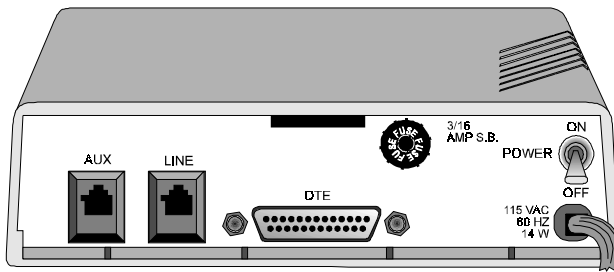


Figure 2-1 Rear Panel Connections

AC Power Connection

Power is supplied through a 6-foot line cord with a grounded 3-wire plug. If common ground is available through the third prong of the plug, a separate ground wire is not required.

DC Power Connection



Caution

To protect the DC to DC converter from damage, ensure the positive and negative leads are properly connected.

If the modem is equipped for dc power input, connect 12 to 60 VDC power to the terminal block attached to the modem back panel. A chassis ground connection is also supplied on the terminal block.

DTE CONNECTION

The DTE connector is a 25-pin D-series type conforming to EIA-232 specifications. Pin signals are shown in Figure 2-2 and described in Table 2-1.

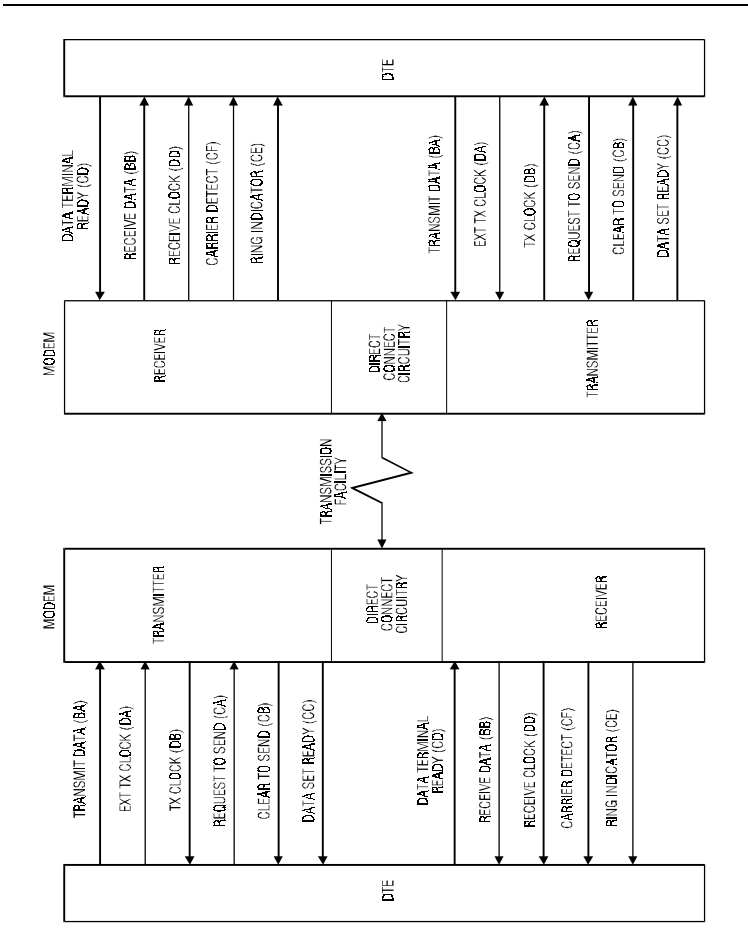


Figure 2-2 Digital Interface Signals

Table 2-1. Digital Interface Signal Descriptions

| Pin No. | EIA-232D | CCITT V.24 | Signal Name | Description |
|----------------|-----------------|-------------------|--------------------------------|--|
| 1 | | 101 | Shield | No connection |
| 2 | BA | 103 | Transmitted Data | Serial digital data (to be modulated) from a data terminal or other digital data source: Synchronous data must be accompanied by the modem transmit clock (pin 15) or by an external data rate clock (pin 24). Data transitions should occur on positive-going clock transitions; asynchronous data does not require a transmit clock. |
| 3 | BB | 104 | Received Data | Serial digital data output to the DTE interface: Sync data is accompanied by an internal data rate (receive) clock (pin 17) that has positive-going transitions on the data transition. Async data does not require a receive clock. |
| 4 | CA | 105 | Request to Send | A positive level to the modem when data transmission is desired |
| 5 | CB | 106 | Clear to Send | A positive level from the modem in response to Request to Send and when the modem is ready to transmit. * |
| 6 | CC | 107 | Data Set Ready | A positive level from the modem when power is on and ready to operate: In dial-up operation, the modem must be off hook to give a high DSR signal.* |
| 7 | AB | 102 | Signal Ground or Common Return | Common signal and DC power ground |
| 8 | CF | 109 | Received Line Signal Detector | A positive level from the modem indicating the presence of a received signal (carrier detect). * |

* Modem options may force these signals on or cause them to be ignored.

Table 2-1. Digital Interface Signal Descriptions (Continued)

| Pin No. | EIA-232D | CCITT V.24 | Signal Name | Description |
|---------|----------|------------|---------------------------------|---|
| 9 | | | +12 Volts | +12 voltage reference |
| 10 | | | -12 Volts | -12 voltage reference |
| 11 | | | Signal Quality Indicator | This circuit indicates probability of errors in the received data: a positive level indicates poor signal quality while a negative level indicates good signal quality. † |
| 15 | DB | 114 | Transmit Clock (DCE) | A transmit data rate clock output for use by an external data source: Positive clock transitions correspond to data transitions. |
| 17 | DD | 115 | Receive Clock | A receive data rate clock output for use by an external data sink: Positive clock transitions correspond to data transitions. |
| 18 | | 141 | Local Loopback (Loop 3) Control | A positive level causes the modem to enter the local analog loopback test mode.* |
| 20 | CD | 108.2 | Data Terminal Ready | This circuit is positive when the DTE is ready to originate or answer a call in dial-up operation. DTR must always be active (high) in 2-wire private line operation. Cycling DTR causes retraining.* |
| 21 | | 140 | Remote Digital Loopback | A positive level causes a digital loopback test mode at the remote modem.* |
| 22 | CE | 125 | Ring Indicator | In direct dial operation this circuit is positive in response to an incoming ring signal.* |
| 23 | CH | 111 | Data Rate Select | Supplies a data rate control input to select primary or fallback data rate: Negative voltage selects primary data rate and positive voltage selects fallback data rate.* |

* Modem options may force these signals on or cause them to be ignored.

† This function can be disabled or its logic sense reversed by hardware straps.
Refer to Strap Options.

Table 2-1. Digital Interface Signal Descriptions (Continued)

| Pin No. | EIA-232D | CCITT V.24 | Signal Name | Description |
|---------|----------|------------|-------------------------|---|
| 24 | DA | 113 | External Transmit Clock | A serial data rate clock input from the data source. Positive clock transitions correspond to data transitions. |
| 25 | | 142 | Test Mode | Indicates the modem is in a test mode |

TELEPHONE LINE CONNECTION

The modem operates in one of three line-related modes:

- Permissive (PSTN)
- Programmable (PSTN)
- Private line

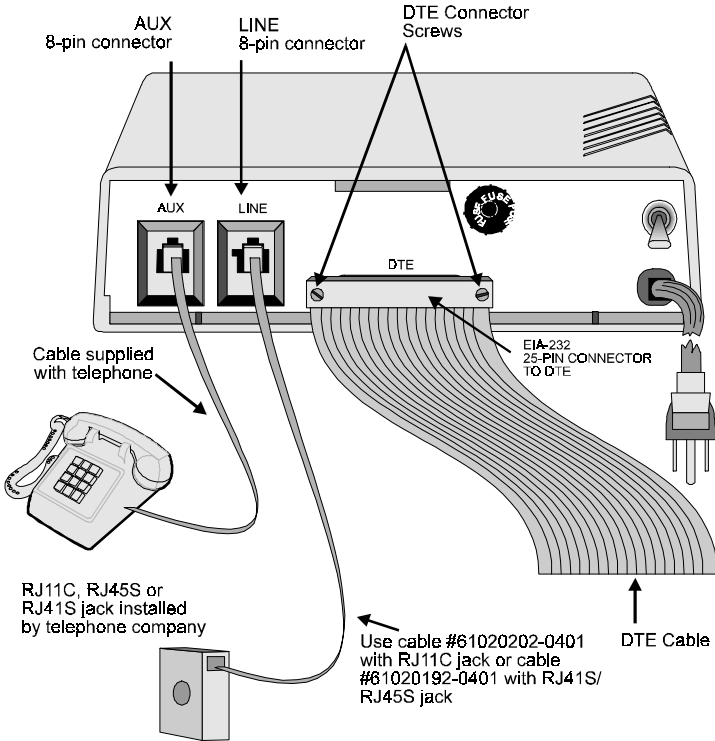
Permissive and programmable modes are used on the Public Switched Telephone Network (PSTN). Private line mode is used on 4-wire or 2-wire leased lines. The user must decide which mode to use and then select the telephone jack arrangement.

PSTN Connection

Modems are registered with the Federal Communications Commission (FCC) for direct connection to the PSTN (dial-up network). The label on the chassis bottom gives the FCC registration number and other information required for network operation.

Direct connection to the PSTN provides two modes of operation (Figure 2-3):

- Permissive (standard domestic or home use)
- Programmable



Notes:

1. The AUX jack is provided on the back of the modem for use with a standard rotary or tone dial telephone regardless of the telephone jack arrangement ordered from the telephone company.
2. This standard rotary or tone dial telephone set can be used for originating a call or for voice communication. For sites requiring only autoanswer capability, a phone is not needed.

Figure 2-3 Dial-up Connection

Permissive

In permissive mode, the modem transmits a maximum signal level of -9 dBm. Signal loss between the modem and telephone company central office is not controlled.

Programmable

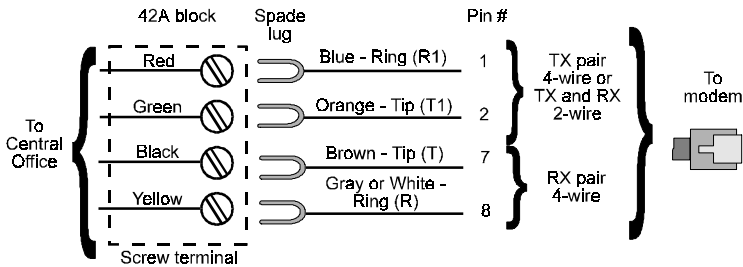
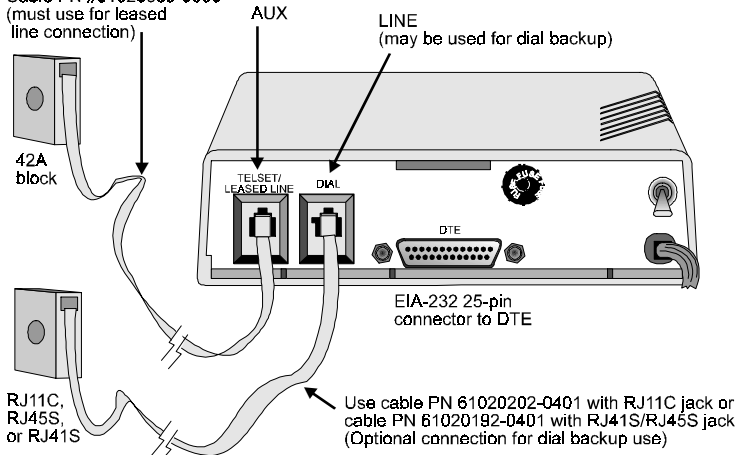
Programmable mode corrects for the signal level loss between the modem and the telephone company central office. This is done by setting the modem transmit output signal level with a fixed-value programming resistor selected and installed in the jack by the telephone company. This allows the output signal to reach the central office at the optimum level of -12 dBm. Jack arrangements for this mode are the RJ45S (Programmable) and RJ41S (Universal). The RJ41S has a switch option that must be selected to Programmed (P). Cable PN 61020192-0401 is used to connect the LINE jack on the back of the modem to the RJ41S or RJ45S wall jack.

Leased Line Connection

Leased lines use either a 2-wire or 4-wire connection. The telephone company will install the leased line and wall jack at your site. The line connects to the modem at the 8-position AUX jack.

Figure 2-4 illustrates the typical hook-up of the modem for operation over private leased lines with dial backup.

Cable PN #61020569-0000
(must use for leased
line connection)



Notes:

1. Set the transmit output level to 0 dBm.
2. DTR, which is the signal on pin 20 of the DTE interface, must be active or the option DTE IGNORED must be set for 2-wire OR 4-wire leased line operation.
3. The connection shown includes dial backup. Connect only the 42A block to the AUX jack for regular leased line use.

Figure 2-4 Leased Line Connection

Chapter 3 Getting Started

OPTION SELECTION

There are six ways to change or select options:

- LCD - Using the front panel LCD and pushbuttons is simple, straightforward, and requires the least amount of technical background. Chapter 4 explains LCD operation.
- AT Commands - The AT compatible command set can be used to select modem options. Chapter 5 describes AT commands.
- V.25 bis Commands - An extended set of V.25 commands allows selection of modem options during synchronous operation. Refer to Chapter 11.
- Status Registers - A series of special ATS commands allows the operator to change the decimal or hexadecimal value of a memory byte to change one or more options in that byte. Chapter 10 describes S-registers.
- Single Bit Status Registers - A second series of special ATS commands allows the user to change single bits within a byte to change an option. Chapter 10 explains single bit control.
- Software program - A wide variety of software programs are available, or advanced computer users can write their own software programs to interact with the modem. This manual does not discuss software programs.

POWERUP

A powerup procedure is not required. Turn the ON/OFF power switch on the rear panel to ON. The modem is factory configured to operate in most public switched telephone applications. If a user has stored a desired option set it will be automatically be restored at power up.

PLACING A CALL

Using a Standard Telephone

1. Lift the telephone receiver. Wait for the dial tone.
2. Dial the number of the remote site.
3. When the answer back tone is heard, immediately press the TALK/DATA button and hang up the telephone. The modems go through a connection sequence and establish a data link. If a data link is not established, return to the first step.
4. After the link is established, hang up the telephone.

Autodial from Front Panel

1. If no number to dial is stored yet advance to Main Menu #6, CHANGE PHONE NUMBER.
2. Enter the number using NO to scroll and YES to select.
3. When number is entered press YES to store the number.
4. Advance the LCD to main #2, DIAL STORED NUMBER.
5. Select number to dial and press YES to dial. After dialing the modems follow the same procedure as when using a standard telephone.

Autodial from a Terminal with the AT Command Set

To dial a number, for example 555-1212, type *AT D 555-1212* and press Enter, or enter *ATDSn* where *n* equals the stored telephone number location 1-9 to dial.

The modem dials the number — either pulse or tone, whichever is currently in effect — and takes the role of the originate modem.

Refer to Dial Commands section in Chapter 5 for additional dialing commands.

ANSWERING A CALL

Autoanswer

Normally the modem is configured to autoanswer on the first ring. A telephone plugged into the AUX jack will also ring.

Manual Answer

On ring detection the modem LCD displays ringing status.

Press TALK/DATA to answer the call and place the modem in the data mode.

Answer from Terminal with AT Command Set.

The modem displays the ring response.

To answer an incoming call type *ATA*. The modem begins sending an answer back tone and attempts to connect to the remote modem.

ENDING A CALL

Call Termination from Front Panel

1. Press TALK/DATA and DO YOU WANT TO DISCONNECT will be displayed.
2. Answer YES.

Call Termination from Terminal with AT Command Set

1. Enter +++ and the modem will enter command mode.
2. Enter *ATH* and the modem will terminate the call.

Reasons for Call Termination

The following conditions cause call termination.

| Condition | Description |
|---|--|
| Abort Disconnect (No answer, busy signal, no modem, etc.) | Default 30 sec; select 1 to 255 sec (S-register 7) |
| ATH | Disconnect command |
| Loss of Carrier Disconnect | Select 100 ms to 25.5 sec (S-register 10) |
| Receive Long Space Disconnect | Disabled or select 2 sec |
| DTR Disconnect | Disabled or select 10 ms to 2.55 sec (S-register 25) |
| Loss of Line Current | |
| Cleardown | A disconnect method used in V.32 and V.34 mode. |
| LCD Display | When TALK/DATA is pressed, the LCD displays DO YOU WANT TO GO TO TALK? When YES is pressed modem hangs up, if no telephone is con- nected or if the connected telephone is not off hook. Pressing NO displays DO YOU WANT TO DISCONNECT? Press YES to disconnect. |
| Train Timeout | Modem fails to establish communication with remote site. Default is 30 seconds (S-register 7) |
| Protocol Link Establishment Failure | Reliable mode only; failure to establish reliable link |
| Inactivity Timeout | Default is 0 or disabled; select for disabled or 1 to 255 minutes (S-register 8) |
| Protocol Retry Limit Exceeded | 12 retransmissions of the frame |
| Minimum DCE Speed | A connection occurred at a rate less than minimum |
| Security Password Failure | Maximum password entry attempts exceeded |
| Security Callback | Security callback is enabled and a new remote con- nection is established. The modem disconnects and places a call to the programmed number |
| Signal Quality | Leased line operation with dial backup enabled; extended loss of carrier or 4 unsuccessful retrains in 3 minutes cause dial backup |
| Test Mode entered Modem power is turned off. | Certain test modes require call termination |

Chapter 4

Front Panel Operation

GENERAL

The function of the LCD front panel is to provide easy real-time access to modem configuration and status. The LCD can be used at any time to modify modem options or obtain information about modem operation and status. All of the major options of the modem can be controlled through the LCD interface without an external terminal or phone line connection. Operation of the LCD can be secured using a password protection feature. A remote modem can even be configured using the local LCD through the use of the front panel remote configuration feature.

LED DESCRIPTIONS

The V.3400 has six LED indicators: TR, CS, RS, CD, RD, and TD. The functions of these LEDs are as follows:

TR - Terminal Ready. This LED lights when the DTE asserts Data Terminal Ready. This signal is input on pin 20 (CCITT V.24/108.2).

CS - Clear to Send. This LED lights when the modem is ready to send data to the DTE. This signal is output on pin 5 (CCITT V.24/106).

RS - Request to Send. This LED lights when the DTE is ready to send data to the modem. This signal is input on pin 4 (CCITT V.24/105).

CD - Carrier Detect. This LED lights when the received audio carrier signal is detected or, if enabled, when error control protocol negotiation is complete. This signal is output on pin 8 (CCITT V.24/109).

RD - Received Data. This LED lights for a data space condition at the receive data output, indicating receive data output activity. This signal is output on pin 3 (CCITT V.24/104).

TD - Transmit Data. This LED lights for a data space condition at the transmit data input, indicating transmit data input activity. This signal is input on pin 2 (CCITT V.24/103).

LCD MENUS

The V.3400 has seven main LCD menus that support modem operations. Table 4-1 lists them in the following sequence:

- MODEM STATUS
- DIAL STORED NUMBER
- DISPLAY STATUS
- SELECT TEST
- MODIFY CONFIGURATION
- CHANGE PHONE NUMBERS
- FRONT PANEL FEATURES

LCD MENU OPERATION

The LCD menu is portrayed by a six column table (Table 4-1). The first column lists the seven main menu categories. The second column is the submenus, listing functions for each category in the main menu. The third column lists specific items for submenu functions. The fourth column lists option choices or status for the specific items in the third column. The fifth and sixth columns in the table show associated AT commands and S-registers as a cross reference.

Each column item has a corresponding header in the previous column. If an option setting is selected or if all settings have been scrolled through, the display will return to that header.

Because of the menu structure and option choices not all main menus use all four columns in Table 4-1. However, option selection and sequence are the same.

In general, while operating in the option menu, pressing NO scrolls vertically down the columns and pressing YES advances horizontally across the columns. However, responding to the LCD prompt is the best method to reach an option.

If the NO pushbutton is pressed and held, the LCD scrolls through the menus.

Press the TALK/DATA button to return to the previous menu.

Table 4-1. Menu Options

| MAIN MENU | | LCD MESSAGES | | | | S-REG |
|-----------|----------------------------------|---|--|---------------------------------|----------------|------------|
| 1 | MODEM STATUS | V.34 28800 IDLE <i>Note:</i> Shows the current modulation, bit rate, and modem status. | | (Press NO to advance to MAIN 2) | | S91 S67 |
| MAIN MENU | | SUBMENU | SUBMENU ITEM | ITEM OPTION | AT COM. | S-REG |
| 2 | DIAL STORED NUMBER? | | DIAL #1-9 | YES, NO | DSn (n-1-9) | --- |
| 3 | DISPLAY STATUS? (status only) | DTE SIGNALS | QM ON/OFF DSR ON/OFF OH ON/OFF RI ON/OFF | DISPLAY STATUS | --- | --- |
| | | PROTOCOL* | NONE MNP 2, 3, 4, or 5 LAPM | DISPLAY STATUS | --- | --- |
| | | COMPRES-SOR* | NONE MNP 5, V.42b | DISPLAY STATUS | --- | --- |
| | | CARRIER DESCRIPTIONS* | RECEIVE LEVEL NEAR END ECHO LEVEL FAR END ECHO LEVEL FAR END ECHO DELAY FREQUENCY TRANSLATION BAUD RATE RX BIT RATE TX BIT RATE | DISPLAY STATUS | --- | --- |
| | | LAST DISCONNECT REASON | DISPLAY STATUS | | I5 | |
| 4 | SELECT TEST? | (Offline test only) | LOCAL ANALOG LOOP | INITIATE, EXIT | &T1 | S16 |
| | | | LOCAL ANALOG LOOP WITH TP | INITIATE, EXIT | &T8 | S16 |

* When modem is not online, the display flashes and shows the status from the last connection.

Table 4-1. Menu Options (Continued)

| MAIN MENU | SUBMENU | SUBMENU ITEM | ITEM OPTION | AT COM. | S-REG |
|------------------------|-----------------------------|-----------------------|-------------------------------|---|---|
| 4 c o n t. | SELECT TEST? (continued) | (Online test) | LOCAL DIGITAL LOOP † | INITIATE, EXIT | &T3 S16 |
| | | | REMOTE DIGITAL LOOP † | INITIATE, EXIT | &T6 S16 |
| | | | REMOTE DIGITAL LOOP WITH TP † | INITIATE, EXIT | &T7 S16 |
| | | | TEST PATTERN† | INITIATE, EXIT | %T --- |
| 5 | MODIFY CONFIGURATION? | CHANGE MODEM OPTIONS? | CHANGE LEASED/DIAL LINE? | 2 WIRE/ 4 WIRE | &L1, &L S27 |
| | | | CHANGE MODULATION? | AUTOMODE V.21 BELL 103 B212A V.22 bis V.27 ter * V.29 * V.33 * V.32bis V.34 | *MM *MM1 *MM2 *MM4 *MM5 *MM6 *MM8 *MM10 *MM11 *MM12 S88 |
| | | | CHANGE MAX DCE RATE? | 28800 26400 24000 21600 19200 16800 14400 12000 7200 9600 9600U 4800 2400 1200 300 DTE SPEED | %B15 %B14 %B13 %B12 %B11 %B10 %B9 %B8 %B7 %B6 %B5 %B4 %B3 %B2 %B1 %B S69 |

† Modem must be online with protocols disabled

* Lease line only

Table 4-1. Menu Options (Continued)

| MAIN MENU | SUBMENU | SUBMENU ITEM | ITEM OPTION | AT COM. | S-REG |
|------------------------|--|--|--|--|-------|
| 5 c o n t. | MODIFY CONFIGU- RATION? (continued) | CHANGE MODEM OPTIONS? (continued) | CHANGE MIN DCE RATE? | 28800 %L15 26400 %L14 24000 %L13 21600 %L12 19200 %L11 16800 %L10 14400 %L9 12000 %L8 7200 %L7 9600 %L6 9600U %L5 4800 %L4 2400 %L3 1200 %L2 DISABLED %L1 DISABLED %L | S69 |
| | | | CHANGE V.34 RATE THRESH- OLD? | LOW BER *TH MED BER *TH1 HIGH BER *TH2 | --- |
| | | | V.34 ASYM RATES | ENABLE *AS1 DISABLE *AS | S96 |
| | | | NORMAL ORIGINATE FORCED ANSWER* | NORMAL *OR ORIG. *OR1 FORCED ANS. | S14 |
| | | | V.22 GUARD TONE | DISEABLE &G 550 Hz &G1 1800 Hz &G2 | S23 |
| | | | V.32 FAST TRAIN | ENABLE *FT1 DISABLE *FT | S29 |
| | | | SQ RETRAIN | ENABLE %E1 DISABLE %E | S60 |
| | | | SQ AUTO RATE | HIGH BER %R3 MED BER %R2 LOW BER %R1 DISABLED %R | S53 |
| | | | TRANSMIT CLOCK SELECT | INTERNAL &X EXTERNAL &X1 RECEIVE &X2 | S27 |

* Lease line only

Table 4-1. Menu Options (Continued)

| MAIN MENU | | SUBMENU | SUBMENU ITEM | ITEM OPTION | AT COM. | S- REG |
|-----------------------------------|--|--|------------------------------|---------------------------------|---|-----------|
| 5 c o n f. i g. | MODIFY CONFIGU- RATION? (continued) | CHANGE MODEM OPTIONS? (continued) | DIAL LINE JACK † | PER - RJ11 PROG - RJ15 | %Z %Z1 | S51 |
| | | | DIAL TRANSMIT LEVEL | -9 dBm to -21 dBm | *TDn | S51 |
| | | | LEASE TRANSMIT LEVEL* | 0 to -21 dBm | *TLn | S52 |
| | | | LINE CURRENT DISCONNECT † | OFF SHORT LONG | *LC, *LC1, *LC2 | S32 |
| | | | LONG SPACE DISCONNECT † | ENABLE DISABLE | Y1 Y | S21 |
| | | | DIAL BACKUP* | MANUAL AUTO- MATIC | *DB *DB1 | S32 |
| | | | LOOKBACK TIME* | 0 DISABLED to 255 MINUTES | --- | S28 |
| | | CHANGE PROTOCOL OPTIONS? | LAPM PROTOCOL | ENABLE | \N4, \N5, \N6, \N7 \N, \N1, \N2, \N3 | S70 |
| | | | | DISABLE | | |
| | | | MNP PROTOCOL | ENABLE | \N2, \N3, \N6, \N7 \N, \N1, \N4, \N5 | S70 |
| | | | | DISABLE | | |
| | | | PROTOCOL FALLBACK | ENABLE | \N3, \N5, \N6, \N7 \N, \N1, \N2, \N4 | S70 |
| | | | | DISABLE | | |
| | | DATA COMPRES- SION | DISABLE NORM TX RX | %C %C1 %C2 %C3 | S56 | |
| | | DTE SPEED | DTE=DCE CONSTANT DTE | \J1 \J | S70 | |

* Lease Line only

† Dial Line only

† Dial Line only

Table 4-1. Menu Options (Continued)

| MAIN MENU | SUBMENU | SUBMENU ITEM | ITEM OPTION | AT COM. | S-REG |
|------------------------|--------------------------------------|---|--|--|-------|
| 5 c o n t. | MODIFY CONFIGURATION? (continued) | CHANGE PROTOCOL OPTIONS? (continued) | DTE FLOW CONTROL | DISABLE XON/XOFF CTS RTS/CTS \Q \Q1 \Q2 \Q3 | S54 |
| | | | DCE FLOW CONTROL | DISABLE XON/XOFF CTS \Q4 \Q5 \Q6, \Q7 | S54 |
| | | | XON/XOFF PASS THROUGH | ENABLE DISABLE \X1 \X | S54 |
| | | | INACTIVITY TIMER | OFF, 15, 30, 45, 60, 75, 90 MIN \TLn | S58 |
| | | | BREAK CONTROL | 0, 1, 2, 3, 4, 5 \K, \K1, \K2, \K3, \K4, \K5 | S59 |
| | | | V.42 FAST DETECT | ENABLE DISABLE \M1 \M | S70 |
| | CHANGE DTE OPTIONS? | OPERATION | SYNC | &M1, 2, 3, 4, 5, 6 &M | S27 |
| | | | ASYNCR | | S30 |
| | | DTE RATE (Async) | 300, 600, 1200, 2400, 4800, 7200, 9600, 12000, 14400, 16800, 19200, 38400, 21600, 24000, 26400, 28800, 57600, 115200 | --- | S80 |
| | | CHAR SIZE (Async) | 7 BIT 8 BIT | --- | S61 |
| | | PARITY (Async) | NO, EVEN, ODD | --- | S61 |

Table 4-1. Menu Options (Continued)

| MAIN MENU | | SUBMENU | SUBMENU ITEM | ITEM OPTION | AT COM. | S- REG |
|------------------------|--|------------------------|-------------------------------|--|-------------------------------------|------------|
| 5 c o n t. | MODIFY CONFIGU- RATION? (continued) | CHANGE DTE OPTIONS? | DIAL METHOD | ASYNCR, DTR, MANUAL, V.25 BISYNCR, V.25 SDLC V.25 bis async | &M1,&M2 &M3 &M4 &M5 &M6 | S27 S30 |
| | | | AT COMMAND SET | ENABLE DISABLE | *NT1 *NT | S29 |
| | | | CHARACTER TYPE (V.25 only) | ASCII, EBCDIC | --- | S30 |
| | | | SDLC DATA FOR- MAT | NRZ, NRZI | --- | S30 |
| | | | DTR STATE | IGNORE RECALL CMD DISCON- NECT RESET | &D &D1 &D2 &D3 | S21 |
| | | | DSR STATE | NORMAL FORCED HIGH OFF 5 SEC ON DISCON- NECT FOLLOWS OH | &S1 &S &S2 &S3 | S21 |
| | | | DCD STATE | NORMAL FORCED HIGH OFF 5 SEC ON DISCON- NECT FOLLOWS REMOTE RTS | &C1 &C &C2 &C3 | S21 |

Table 4-1. Menu Options (Continued)

| MAIN MENU | SUBMENU | SUBMENU ITEM | ITEM OPTION | AT COM. | S-REG |
|------------------------|--------------------------------------|------------------------------------|--------------------------------|--|---|
| 5 c o n t. | MODIFY CONFIGURATION? (continued) | CHANGE DTE OPTIONS? (continued) | CTS STATE | NORMAL FORCED HIGH CTS FOL- LOWS DCD CTS=RTS | &R &R1 &R2 &R9 S21 S72 |
| | | | RTS/CTS DELAY | 0 to 150 ms (10 ms) | --- S26 |
| | | | DTE COM- MANDED FALLBACK | ENABLE DISABLE | *FB1 *FB S53 |
| | | | OPTIONS RES/ RETND AT DISC | RESTORED RETAINED | *RO1 *RO S29 |
| | | CHANGE TEST OPTIONS? | BILATERAL DIGITAL LOOP | ENABLE DISABLE | *DG1 DG S34 |
| | | | DTE LOCAL TEST | ENABLE DISABLE | *LA1 *LA S34 |
| | | | DTE REMOTE TEST | ENABLE DISABLE | *RD1, *RD S34 |
| | | | REMOTE COM- MANDED | ENABLE DISABLE | &T4 &T5 S23 |
| | | | TEST TIMEOUT | OFF, 60, 120, 180. 240 SEC | --- S18 |
| | | CHANGE DIAL OPTIONS? | DIAL TYPE | PULSE, TONE | P, T S14 |
| | | | AUTODIAL # | OFF, 1 - 9 | *AUn (n=1-9) --- |
| | | | DIAL TONE | BLIND DIAL WAIT FOR DIAL TONE | X, X1, X3 X2, X4 S22 |
| | | | WAIT DELAY (Blind Dial) | 1, 2, 3, 4, 8, 16, 32 SEC | --- S6 |
| | | | PAUSE DELAY | 1, 2, 3, 4, 8, 16, 32 SEC | --- S8 |
| | | | CALL TIMEOUT | 15, 30, 45, 60, 75, 90, 105, 120 SEC | --- S7 |

Table 4-1. Menu Options (Continued)

| MAIN MENU | | SUBMENU | SUBMENU ITEM | ITEM OPTION | AT COM. | S- REG |
|------------------------|--|--|------------------------------|--|-----------------------------|-----------|
| 5 c o n t. | MODIFY CONFIGU- RATION? (continued) | CHANGE DIAL OPTIONS? (continued) | ANSWER RING #X | 1, 2, 4, 8, 16 | --- | S0 |
| | | | AUTOCALLBACK | ENABLE, DISABLE | --- | S72 |
| | | CHANGE SPEAKER OPERATION? | VOLUME CONTROL | LOW MEDIUM HIGH | L1 L2 L3 | S22 |
| | | | SPEAKER CONTROL | ON UNTIL CARR DETECT ALWAYS ON OFF WHILE DIALING ALWAYS OFF | M1 M2 M3 M | S22 |
| | | LOAD/STORE OPTION SET? | LOAD FACTORY OPTION | NO, 1-9 | &Fn (n=1-9) | --- |
| | | | LOAD USER OPTION SET | 1 2 | Z0 Z1 | --- |
| | | | STORE PRESENT OPTIONS | 1 2 | &W &W1 | --- |
| | | | USER OPTION AT RESET | 1 2 | &Y &Y1 | --- |
| 6 | CHANGE PHONE NUMBERS? | PHONE NUMBER | ENTER NUMBER 32 digits | &Zn (n= phone # and modi- fiers) *CNn,x | --- | |
| 7 | FRONT PANEL FEATURES? | CHANGE RMT PASSWORD? | ENTER PASSWORD | %P | --- | |
| | | ENTER REMOTE CONFIGURATION | ENTER REM CFG PASSWORD | %T | --- | |
| | | EXIT REMOTE CONFIGURATION | EXIT | &T | --- | |

Table 4-1. Menu Options (Continued)

| MAIN MENU | SUBMENU | SUBMENU ITEM | ITEM OPTION | AT COM. | S-REG |
|------------------------|--|--------------------------------|------------------------|---------|-------|
| 7 c o n t. | FRONT PANEL FEATURES? (continued) | CHANGE FRONT PANEL PASSWORD | ENTER PASSWORD * | --- | --- |
| | | | ACTIVATE SECURITY | --- | --- |

* Password of 0000 disables front panel security.

FRONT PANEL SECURITY

The Front Panel Security feature provides password protection for front panel menu access. The modem is shipped from the factory with this feature disabled.

The Front Panel Security password is a 4-digit string that can be set to any combination of digits from "0000" to "9999". Selecting a password of "0000" disables Front Panel Security; any other password enables it.

When this feature is enabled there are two ways it may be activated. It may be explicitly activated via a front panel screen under Main Menu #7, or the modem will activate it when no front panel buttons have been pressed for 3 minutes. When Front Panel Security is activated, the front panel menu will return to Main Menu #1 and the front panel will become secured.

While in this secured state, the Main Menu #1 screen continues to maintain modem status, but a password must be entered before other front panel screens may be accessed. Pressing any front panel button causes the modem to prompt for the front panel password. After the password has been entered, a message briefly displays the result of the password validation process and, depending on the result, Front Panel Security either becomes inactive or returns to its active state.

During password entry, the front panel buttons are interpreted as follows:

NO

Pressing the NO button causes the character at the cursor to change to the next valid password character.

- | | |
|-----------|--|
| YES | Pressing the YES button while the cursor is on any of the first three password characters causes the cursor to advance to the next password character. When the cursor is on the last password character, pressing the YES button causes the modem to accept the displayed password. |
| TALK/DATA | Pressing the TALK/DATA button while the cursor is on the first password character causes the password entry to be aborted. When the cursor is on any other character, this button causes the cursor to move to the first password character. |

Chapter 5

AT Commands

GENERAL

This chapter describes commands used to select options and to operate the modem. Some options depend on or are restricted by the mode of operation.

COMMAND CATEGORIES

The modem offers eight major categories of command statements:

- Response
- Dial
- Answer
- Terminal Interface
- General
- Private Line
- Configuration
- Remote Configuration

Six other groups of AT commands are discussed in their respective chapters:

- Protocol
- Test
- Security
- Fax
- S-registers

OPERATION MODES

During asynchronous operation the modem functions in one of three modes:

- Offline Command Mode
- Online Command Mode
- Data Mode

Offline Command Mode

In offline command mode (generally referred to as command mode), the modem communicates with the computer or terminal. Commands can be entered separately or in strings. There is no data communication link established in this mode.

Online Command Mode

This mode is entered from the data mode after the escape command has been entered. The escape command is performed by entering the escape character (+ is the default) three times. The data communication link remains established but data transmission is suspended. The modem will now accept commands like it does in the offline command mode.

Data Mode

The modem goes to data mode (online) after it acknowledges the proper signal and successfully connects with a compatible modem. In data mode, the modem sends and receives data, but will not accept or execute command instructions.

Example: The modem is in the command state. The *D* command and phone number are used to dial a remote modem. The local modem waits to receive an answer back tone from the remote modem. When the local modem receives the carrier, it leaves the command state and goes online in the data mode. At this time, both modems are using the telephone line and a communication link is established.

SENDING COMMANDS TO THE MODEM

When the computer, modem, and monitor are on, an instruction can be sent to the modem telling it what function or activity to perform. The instruction, called a command statement, command string, or just command, is typed using the computer/terminal keyboard. The command statement temporarily resides in a section of memory called the command buffer.

Each command statement is made up of characters, numbers, and such keyboard symbols as the *&* and *%* signs. Commands must be written in a specific form so the modem recognizes and follows the instruction.

Creating a Command Statement AT

To create a command statement use the following steps:

- Type *AT*. This is the Attention Code telling the unit a command statement follows.
- Type the command.
- Press the Enter key to send the command statement to the modem.

An example of a command statement using the dial command (*D*) follows.

ATD554-1212

This statement can be read as

Attention: Dial 554-1212.

Another AT command statement example is

ATZ

This statement can be read as

Attention: execute the *Z* command.

After entering a command line the modem returns a response message indicating whether or not the command was accepted or giving the data requested by the command line.

To clear command statements from the buffer you can either

- Turn the modem off,
- Enter *AT*, or
- Use the DTR reset feature.

Autobaud

The attention code (*AT*) is analyzed by the modem to determine the transmission speed, parity, and bits per character used by the DTE. This autobaud process is repeated each time the AT command prefix is sent.

Guidelines for Creating Command Statements

When typing command statements, note the following:

The attention code (AT) may be upper or lower case but not a combination like aT.

- Press the Enter key to execute a command.
- The command buffer can hold 80 characters.
- Use the backspace or delete key to erase the last character.

Even though the initial AT code must be all upper or lower case, characters that follow can be any mix of upper and lower case.

Monitor Display

As commands are typed they appear on the monitor so the operator can verify the input. This is called local character echo. The echo may be turned on or off using AT commands. Refer to *Local Character Echo* in the *General Commands* section of this chapter for details.

Command Statement Buffer

The modem temporarily stores up to 80 characters in the command buffer. If this limit is exceeded, the modem does not accept the command and sends an ERROR message. To correct this condition, retype the command using 80 characters or less.

The AT characters and punctuation used in telephone numbers do not take up space in the buffer. Also, blank characters used as spaces to help increase readability are not counted. For example, the modem reads the commands

```
ATD (212) 554-1212
ATD2125551212
ATD 212 555 1212
```

as having 11 characters each. Commands can be typed in any of these forms.

Backspace Key

Use the backspace key to change the command statement or correct errors. The backspace key allows the cursor to be moved back to the character(s) in error. The command can then be retyped from that point.

Example: *ATD5551211* has been typed. To change the last *1* to *2*, press the Backspace key once, type *2*, and press Enter to execute the command.

Repeating a Command *A/*

This command tells the computer to repeat the last command stored in its buffer. It automatically reexecutes the command without retyping. The return key does not need to be pressed.

Example: The *ATD5551212* command has been executed, and the phone is busy. To repeat the instruction type *A/*. Do not use *AT* before this command as *AT* empties the buffer and there would be no command to repeat.

Numbered Commands

Series of commands that start with the same letter are distinguished by a number following the letter.

For example, the *M0* command selects speaker always off, *M1* speaker on until carrier detected, and *M2* selects speaker always on.

In all cases, the zero (0) may be omitted so the commands *M* and *M0* are identical. For clarity, this manual uses the nonzero form of commands. The modem treats both the same but zeros count against the buffer total.

Group Commands

A group of commands can be typed in a single command statement. Pressing the Enter key sends the entire command string to the modem, which executes each command individually in the order it appears in the command statement reading from left to right.

For example, the command statement *ATQ0V0L3DT5551212* means

- *AT* Attention.
- *Q* Allow response messages to be sent.
- *V* Select digit code responses.
- *L3* Select high volume.
- *DT* Tone dial 555-1212.

The modem executes the AT command followed by the *Q*, *V*, *L*, *D*, and *T* commands. *ATQ0V0L3DT5551212* can be read as *ATQVL3DT5551212*. Eliminating zeros reduces the number of characters, allowing more room in the buffer.

The dial *D* command initiates the dial process so no other commands, only dial modifiers, can follow it.

RESPONSE COMMANDS

The modem communicates with the operator through response messages. These appear on the monitor or a computer printout to show the result of the command or action executed. Response messages can appear as words or numbers.

Digit / Word Selection **V**

The *V* command tells the modem which type of response message to show on the monitor. Some software requires digit response messages but words are easier to remember.

| Command | Operation |
|---------|----------------------------------|
| V | Enables digit response messages |
| V1 | Enables word response messages * |

* default

Response Displays Q

The *Q* command enables or disables response messages. The modem still responds to commands when the response display is inhibited.

| Command | Operation |
|---------|--|
| Q | Response display on* |
| Q1 | Response display off |
| Q2 | Response display on in originate mode only |

* default

Negotiation Displays W

The *W* command enables or disables negotiation response messages.

These messages are verbose negotiation status displays to alert the user to the link rate, protocol, and DTE rate.

| Command | Operation |
|---------|---------------------------------|
| W | Disables negotiation displays * |
| W1 | Enables negotiation displays |
| W2 | Displays DCE link rate only |

* default

Protocol Result Codes \V

Enable or disable protocol result codes. Table 5-1 lists these codes.

| Command | Operation |
|---------|---------------------------------|
| \V | Disable protocol result codes * |
| \V1 | Enable protocol result codes |

* default

Call Progress / Connect Speed Messages X

The *X* command selects response code/message displays and dialing options such as call progress monitoring, busy signal or dial tone detection and blind dialing.

| Command | Operation |
|---------|--|
| X | Dial tone and busy signal detection not selected; CONNECT (code 1) response messages displayed for all speeds |
| X1 | Dial tone and busy signal detection not selected; appropriate CONNECT response messages or codes displayed for data rate |
| X2 | Dial tone detection only; NO DIAL TONE message or code appears if dial tone not detected within 5 sec |
| X3 | Busy signal detection only; BUSY message or code appears if dialed number is busy |
| X4 | Dial tone and busy signal detection; appropriate CONNECT message or code displayed * |

* default

The X command followed by a dial command causes the modem to go off hook, wait the amount of time set in register S6, and dial the number. If connection is made the modem returns a CONNECT (code 1) message to the screen regardless of the speed of connection. With a basic response, the modem will not detect a busy or no dial tone condition.

The X1 command followed by a dial command causes the modem to go off hook, wait the amount of time set in register S6, and dial the number. If connection is made the modem returns a appropriate CONNECT message or code to the screen. The modem will not detect a busy or no dial tone situation.

The X2 command followed by a dial command causes the modem to go off hook and wait for a dial tone before dialing. If a dial tone is not detected within 5 seconds, the modem sends a NO DIALTONE message and hangs up. The modem will not detect a busy situation in this mode.

The X3 command followed by a dial command causes the modem to go off hook, wait the amount of time set in register S6 and dial the number. If a busy signal is detected, the modem sends a BUSY message and

hangs up. If the call is completed, the appropriate CONNECT message similar to *X1* will be displayed. The modem will not detect a no dial tone situation.

The *X4* command followed by a dial command causes the modem to go off hook and wait for a dial tone before dialing. If a dial tone is not detected within 5 seconds, the modem returns a NO DIALTONE message and hangs up. If a busy signal is detected, the modem returns a BUSY message and hangs up. If the call is completed, the appropriate CONNECT message similar to *X1* will be displayed.

The *X4* command combines all the features of *X1*, *X2*, and *X3*. The factory setting is *X4*.



Note

When an X2, X3, or X4 command is in effect, an appropriate CONNECT data rate message or code is displayed as for X1. When a blind dial command (X, X1, X3) is in effect, the modem waits 2 seconds or the time set by S6 and then dials.

Number Code Application *RC

Some communications software packages use different number codes to indicate the data rate of the serial port. This option selects either of two commonly used number code sets.

| Command | Code Set | Number | Operation |
|---------|------------|----------|----------------------|
| *RC | Standard * | 15 18 | 4800 bps 9600 bps |
| *RC1 | Alternate | 11 12 | 4800 bps 9600 bps |

* default



Note

Asterisks in AT commands are part of the command and do not indicate footnotes.

Response Number Codes / Messages

Response number codes, messages, and their corresponding meanings are listed in Table 5-1. The connect speeds indicated are the serial port rate (DTE), not the DCE speed.

Table 5-1. Response Messages

| Code | Message | Meaning |
|-------------|------------------|---|
| 0 | OK | Command received |
| 1 | CONNECT | Connect at 300 bps while X1, X2, X3, or X4 command in effect; all rates while X command in effect |
| 2 | RING | Ring detected |
| 3 | NO CARRIER | Valid carrier not detected within period specified by register S7, or carrier lost for value of S10 or more |
| 4 | ERROR | Command not recognized or too long |
| 5 | CONNECT 1200 | Connection made at 1200 bps |
| 6 | NO DIAL TONE | No dial tone detected for 5 seconds (X2 or X4 command in effect) |
| 7 | BUSY | Dialed number busy (X3 or X4 command in effect) |
| 9 | CONNECT 7200 | DTE rate 7200 bps |
| 10 | CONNECT 2400 | DTE rate 2400 bps |
| 11, 15 | CONNECT 4800 | DTE rate 4800 bps |
| 12, 18 | CONNECT 9600 | DTE rate 9600 bps |
| 13 | CONNECT 12000 | DTE rate 12000 bps |
| 14 | CONNECT 19200 | DTE rate 19200 bps |
| 16 | CONNECT 38400 | DTE rate 38400 bps |
| 17 | CONNECT 14400 | DTE rate 14400 bps |
| 19 | CONNECT 57600 | DTE rate 57600 bps |
| 20 | CONNECT 0300/REL | MNP 300 bps connection |
| 22 | CONNECT 1200/REL | MNP 1200 bps connection |
| 23 | CONNECT 2400/REL | MNP 2400 bps connection |
| 24 | CONNECT 4800/REL | MNP 4800 bps connection |
| 25 | CONNECT 9600/REL | MNP 9600 bps connection |

Table 5-1. Response Messages (Continued)

| Code | Message | Meaning |
|-------------|------------------------|---------------------------|
| 26 | CONNECT 19200/REL | MNP 19200 bps connection |
| 27 | CONNECT 38400/REL | MNP 38400 bps connection |
| 28 | CONNECT 7200/REL | MNP 7200 bps connection |
| 29 | CONNECT 12000/REL | MNP 12000 bps connection |
| 30 | CONNECT 14400/REL | MNP 14400 bps connection |
| 31 | CONNECT 57600/REL | MNP 57600 bps connection |
| 32 | CONNECT 600/REL | MNP 600 bps connection |
| 34 | CONNECT 300/LAPM | LAPM 300 bps connection |
| 35 | CONNECT 600/LAPM | LAPM 600 bps connection |
| 36 | CONNECT 1200/ LAPM | LAPM 1200 bps connection |
| 37 | CONNECT 2400/ LAPM | LAPM 2400 bps connection |
| 38 | CONNECT 4800/ LAPM | LAPM 4800 bps connection |
| 39 | CONNECT 9600/ LAPM | LAPM 9600 bps connection |
| 40 | CONNECT 14400/ LAPM | LAPM 14400 bps connection |
| 41 | CONNECT 19200/ LAPM | LAPM 19200 bps connection |
| 42 | CONNECT 38400/ LAPM | LAPM 38400 bps connection |
| 43 | CONNECT 12000/ LAPM | LAPM 12000 bps connection |
| 44 | CONNECT 7200/ LAPM | LAPM 7200 bps connection |
| 45 | CONNECT 57600/ LAPM | LAPM 57600 bps connection |
| 50 | CARRIER 300 | Link rate 300 bps |
| 51 | CARRIER 1200 | Link rate 1200 bps |
| 52 | CARRIER 2400 | Link rate 2400 bps |

Table 5-1. Response Messages (Continued)

| Code | Message | Meaning |
|------|-------------------------|--|
| 53 | CARRIER 4800 | Link rate 4800 bps |
| 54 | CARRIER 7200 | Link rate 7200 bps |
| 55 | CARRIER 9600 | Link rate 9600 bps |
| 56 | CARRIER 12000 | Link rate 12000 bps |
| 57 | CARRIER 14400 | Link rate 14400 bps |
| 58 | CARRIER 16800 | Link rate 16800 bps |
| 59 | CARRIER 19200 | Link rate 19200 bps |
| 60 | CARRIER 21600 | Link rate 21600 bps |
| 61 | CARRIER 24000 | Link rate 24000 bps |
| 62 | CARRIER 26400 | Link rate 26400 bps |
| 63 | CARRIER 28800 | Link rate 28800 bps |
| 64 | CARRIER 600 | Link rate 600 bps |
| 65 | PROTOCOL NEGOTIATING | Training process complete and protocol negotiation begins |
| 70 | PROTOCOL NONE | No protocol active |
| 71 | PROTOCOL MNP LEVEL 1 | MNP level 1 active |
| 72 | PROTOCOL MNP LEVEL 2 | MNP level 2 active |
| 73 | PROTOCOL MNP LEVEL 3 | MNP level 3 active |
| 74 | PROTOCOL MNP LEVEL 4 | MNP level 4 active |
| 75 | PROTOCOL MNP LEVEL 5 | MNP level 5 active |
| 76 | PROTOCOL V.42 | V.42 LAPM active |
| 77 | PROTOCOL V.42BIS | V.42 bis LAPM compression active |
| 78 | CONNECT 300 | DTE rate 300 bps |
| 79 | CONNECT 600 | DTE rate 600 bps |
| 80 | CONNECT 16800 | DTE rate 16800 bps |
| 81 | CONNECT 21600 | DTE rate 21600 bps |
| 82 | CONNECT 24000 | DTE rate 24000 bps |

Table 5-1. Response Messages (Continued)

| Code | Message | Meaning |
|------|-------------------------|----------------------------|
| 83 | CONNECT 26400 | DTE rate 26400 bps |
| 84 | CONNECT 28800 | DTE rate 28800 bps |
| 85 | CONNECT 115200 | DTE rate 115200 bps |
| 95 | CONNECT 21600/ LAPM | LAPM 21600 bps connection |
| 96 | CONNECT 24000/ LAPM | LAPM 24000 bps connection |
| 97 | CONNECT 26400/ LAPM | LAPM 26400 bps connection |
| 98 | CONNECT 28800/ LAPM | LAPM 28800 bps connection |
| 99 | CONNECT 115200/ LAPM | LAPM 115200 bps connection |

DIAL COMMANDS

Dial commands let the modem originate a call to another modem. These commands can be used with either tone or pulse dial telephone systems. Commands for call answering are included at the end of this section.

Dialing D

To dial a number, for example *554-1212* insert the *D* command in the dialing sequence.

AT D 554-1212

The modem dials the number, either pulse or tone, whichever is currently in effect, and takes the role of the originate modem.

Use spaces, hyphens, parentheses, or other punctuation except dial modifiers to make the command line easier to read and enter. For example, these are all treated the same:

AT D 1-800-555-1212
AT D 1 (800) 555-1212
ATD18005551212

The dial modifiers are shown in Table 5-2.

Table 5-2. Dial Modifiers

| Command | Operation |
|---------|--|
| T | Tone dialing* |
| P | Pulse dialing |
| , | Insert a long pause (2 sec or value in S8) |
| W | Wait for 2nd dial tone |
| ! | Flash (1/2 sec) |
| R | Switch to answer mode after dialing |
| ; | Return to command mode after dialing |
| @ | Wait for silence |
| S | Dial stored command line or number |

* default

Tone Dialing T

To tone dial a number sequence, insert a *T* in the dial sequence.

AT D T 323-1111

In this example, the modem tone dials the telephone number. The dialing method selected remains in effect until changed.

Pulse Dialing P

To pulse dial a number sequence, insert a *P* in the dial sequence.

AT D P 554-9902

Insert Long Pause ,

To insert a long pause in the dialing sequence, use a comma. This inserts a 2 second delay (or the value in register S8).

AT D P 9, 1-800-554-1000

Here the modem pulse dials a 9, pauses for the telephone system to switch to an outside line, then dials the phone number. Comma pauses may be inserted consecutively if desired.

Wait for Second Dial Tone W

To wait for second dial tone insert a *W* in the dialing sequence.

AT D 9 W 323-8000

Instead of using a comma pause for an outside line, wait up to 30 seconds (time specified by *S7*) for a second dial tone.

Hook Flash !

To flash the switchboard, insert an exclamation mark in the dialing sequence.

AT D T 9W 323-8000 ,!, #7 377

This inserts a 0.5 second on hook condition, usually for transferring a call or similar use.

In this example, the modem tone dials a 9, waits for the second dial tone, dials the phone number, pauses, flashes to start the transfer, pauses twice, then uses #7 to transfer the call to extension 377.

Switching to Answer Mode after Dialing R

To switch to answer mode after dialing, use an *R* at the end of the dial sequence.

AT D 554-2345 R

Use this command suffix to call an originate-only modem.

Remaining in Command Mode ;

To remain in command mode after dialing, place a semicolon at the end of the dial sequence.

AT D 234-5678;

The modem will dial the telephone number entered but will not attempt to train when the remote service answers the call.

This is used to retain control so that further dialing tones may be entered with the following:

AT DTn; (n= additional tones to be sent)

Wait for 5 Seconds of Silence @

To wait for 5 seconds of silence (no answer back tone) after accessing an electronic service, use the @ command in the dialing sequence.

AT D 399-4700 @ 2251 ;

In this example the modem dials the number and, after the connection, waits for 5 consecutive seconds of silence. The modem then sends service code 2251 and returns to command mode for further input.

For example, you might enter a dollar amount for a banking transaction by entering

AT D 1400 ;

This sends the sequence 1400 and then returns to the command mode for further entries, according to the requirements of the banking service.

Dialing a Stored Telephone Number Sn

To dial one of the previously stored numbers, enter Sn where n represents a stored telephone number location between 1 and 9.

AT D S9

In this example, the number stored in location 9 is dialed.



Note

DS and DS1 are the same location.

Autodial Number Location *AUn

The **AUn* command selects stored number n ($n=1$ to 9) to be autodialed. This is the autodial number, which is used for any autodial application.

Voice Calls

To make a voice call, dial the number with the telephone. To use the dial command for the call, enter the following dialing sequence.

AT D (number);

The ; modifier recalls the command mode and prevents the modem from training. The remote site must be answered by the telephone for the voice call to be successful.

Switching from Voice to Data

After dialing, place the modems at both ends in data mode by pressing the TALK/DATA button. The **DA1* command can also be used to change from talk mode to data mode.

ANSWERING A CALL

There are three ways to answer a call for a data connection:

- Manual
- AT Command
- Autoanswer

The most common is autoanswer.

Manual Answer

When the phone rings, answer by pressing the TALK/DATA button.

AT Command Answer A

The modem can be made to go off hook in the answer mode by entering *ATA* when the phone rings. This commands the modem to go to the answer mode and connect.

Autoanswer S0

Autoanswer is controlled by register *S0*. *S0* determines which ring the modem answers on. *S0* can be loaded with a value between 1 and 255 for autoanswer.

Entering *ATS0=0* disables the autoanswer feature. Decide which ring the modem is to answer on and set *S0* to that decimal value.

When *S0* is one or greater, the modem automatically answers on the selected ring and connects with the calling modem.



Note

If the modem is set to respond to DTR the DTR signal must be on for autoanswer to work.

TERMINAL INTERFACE COMMANDS

The EIA-232 interface connects the modem and DTE. Terminal interface commands control the action of the modem and the terminal in response to the signals being exchanged on the interface pins. Refer to Table 2-1.

Data Carrier Detect &C

When using DCD to indicate a valid carrier, use the **&C1** command. Some terminals and other devices require DCD on in order to communicate with the modem; if so, use the **&C** command.

| Command | Operation |
|---------|---|
| &C | DCD always on* |
| &C1 | DCD is on when the modem recognizes remote modem carrier or if enabled when protocol negotiation is complete. |
| &C2 | DCD on except for 5 seconds after disconnect |
| &C3 | DCD follows RTS on remote modem (simulated switched carrier V.13). |

* default

AT&C3 is used to simulate switched carrier operation.



Note

For simulated switched carrier operation &C3 must be selected on both modems. Not available in the B103 and V.21 modulation modes.

Data Set Ready &S

These commands control the DSR signal generated by the modem to indicate that the modem is ready for operation. DSR must be on for some terminals and devices to communicate with the modem.

| Command | Operation |
|---------|---|
| &S | DSR always on* |
| &S1 | DSR on when off hook in data mode |
| &S2 | DSR off for 5 seconds after disconnect then returns to on |
| &S3 | DSR follows off hook (OH) signal |

* default

Data Terminal Ready &D

In data mode DTR may be used for modem control.

| Command | Operation |
|---------|--|
| &D | The modem ignores DTR.* |
| &D1 | The modem goes to command mode from data mode when DTR goes from on to off. |
| &D2 | Disconnects when DTR goes from on to off; disables autoanswer while DTR is off |
| &D3 | Disconnects, recalls command mode, and resets the modem to a stored configuration when DTR goes from on to off In dial line mode the modem disconnects; in leased line, the modem retrains. |

* default

**Note**

If DTR controls dialer is selected, then selecting DTR active will cause an autodial after an off-to-on transition of DTR.

Serial Port Ring Indicator (Pin 22) \R

The \R commands determines how the ring indicate signal operates on pin 22 of the EIA-232 DTE connector.

| Command | Operation |
|---------|---|
| \R | Causes ring indicate signal on pin 22 to turn on (high) during each ring and remain on during the call |
| \R1 | Causes ring indicate signal on pin 22 to turn on (high) during each ring and turn off (low) when the call is answered * |

* default

Request to Send / Clear to Send &R

When the modem is operating in nonbuffered mode (direct mode) or in synchronous mode, &R enables the RTS to CTS delay determined by the value in S26. &R1 forces CTS high and the modem ignores RTS (default). With &R2 selected CTS goes high when carrier is detected. &R9 forces CTS to follow the state of RTS without delay.

| Command | Operation |
|---------|--------------------------|
| &R | Enables RTS to CTS delay |
| &R1 | CTS forced on* |
| &R2 | CTS follows DCD |
| &R9 | CTS equals RTS |

* default



Note

RTS/CTS delay is not valid in buffered mode or with error control enabled.



Note

With &R2 selected, XON/XOFF is the only valid method of flow control and &C and &C1 are the only valid carrier detect options.

DTE Controlled Fallback Rate (Pin 23) *FB

Pin 23 of the EIA-232 DTE connector provides signal input to the modem for DTE fallback. If the modem is not using DTE fallback, set this option to ignore pin 23. To cause the modem to act on high/low levels of pin 23, enable this option. Negative level forces a higher rate for primary data rate; positive forces a lower rate providing a fallback rate.

| Command | Operation |
|---------|------------------------------------|
| *FB | Ignore pin 23 * |
| *FB1 | Transition on pin 23 changes speed |

* default

GENERAL COMMANDS

This series of commands control various standard options that in most cases apply to any mode of operation.

Changing from Data Mode to Command Mode +++

To exit data mode and go to online command mode, press the escape character three times (+ is the default). Pause for the length of time set by register *S12* (1 second is the default) before and after the +++ to ensure the modem recognizes the escape command.

This sequence temporarily suspends data mode transmissions and allows command mode operations without breaking or otherwise disturbing the telephone line connection. The modem responds with OK when it detects the escape code. Return to data mode by entering the *O* command.

**Note**

The AT command set must be enabled.

Local Character Echo E

Type *AT* without a carriage return. If the screen shows *AT* character echo is correct. Proceed with other commands as desired.

If the screen shows *AATT* enter the *E* command to correct the double characters or disable character echo by the modem.

If the screen shows no characters, enter the *E1* command to turn modem echo on or enable local echo on the terminal.

| Command | Operation |
|---------|-----------|
| E | Echo off |
| E1 | Echo on * |

* default

Online Character Echo F

In some lower speed modems the *F* command determines if characters are echoed to the DTE from the modem when online. This function is generally controlled by the communications software. The modem does not support online character echo.

Hanging Up H, H1

To end a call, enter the *H* command. This tells the modem to disconnect and go on hook. The modem must be in command mode to use this command.

Enter the *H1* command to take the modem off hook. The modem automatically goes off hook when a dial command is keyed in.

Fast Disconnect H2, H3

The results of the *H* command can be modified by the *H2* and *H3* commands. *H2* or *H3* will not cause a hang up but will affect the method of hanging up the next time the *H* command is issued. If *H2* is entered, the *H* command will hang up according to CCITT V.32 standards. If operating in V.32b mode the *H2* command could take several seconds. If *H3* (the fast command) is entered, the *H* command will hang up much more rapidly at those speeds.

| Command | Operation |
|---------|--|
| H | The modem hangs up. |
| H1 | Forces modem off hook |
| H2 | Sets H command to normal hangup procedure (long space, clear-down, protocol) * |
| H3 | Sets H command to fast hang up |

* default

EPROM Check I

PC software packages may issue the *I* command to verify the modem will support all commands needed by the software package. The modem returns ASCII characters representing the model and revision level. To request the checksum to be calculated on the EPROM, enter the *I1* command. The modem returns four ASCII characters representing the CRC in hexadecimal form. Enter the *I3* command to request the product version.

| Command | Operation |
|---------|------------------------------|
| I | Request product code |
| I1 | Request EPROM checksum value |
| I3 | Request product version |
| I4 | Request capability code |
| I5 | Last disconnect reason |

Speaker Volume L

The *L* commands offer three volume levels.

| Command | Operation |
|---------|-------------------------|
| L, L1 | Speaker volume low |
| L2 | Speaker volume medium * |
| L3 | Speaker volume high |

* default

Speaker Control M

The *M* commands enable or disable the speaker for monitoring purposes.

| Command | Operation |
|---------|--|
| M | Disables the speaker |
| M1 | Disables the speaker while receiving a carrier signal * |
| M2 | Speaker always on |
| M3 | Disables the speaker while dialing and after a carrier is detected |

* default

Return Online **O**

Use the *O* command when operating in the online command mode and need to return to data mode. It returns the modem to the same mode (originate or answer) that it was in before escaping to the (online) command mode. Enter the *O1* command to cause a retrain to occur before going back to data mode.

Long Space Disconnect **Y**

One method of disconnecting two modems is called long space disconnect. When any disconnect condition is detected by the local modem, it will send 4 seconds of data space condition to the remote modem before disconnecting. This signals the remote modem to disconnect. The local modem will disconnect if it receives 1.6 or more seconds of data space condition from a remote modem. If break sequences of 1.6 or more seconds are to be sent, enter the *Y* command to disable this feature and prevent unintentional disconnects.



Note

This option must be disabled if SDLC NRZI data is used.

| Command | Operation |
|---------|---------------------------|
| Y | Long space disconnect off |
| Y1 | Long space disconnect on* |

* default

V.22 bis Guard Tones **&G**

Guard tones are not used in the United States. If required where operating the unit, select the appropriate guard tone.

| Command | Operation |
|---------|--------------------|
| &G | No guard tone* |
| &G1 | 550 Hz guard tone |
| &G2 | 1800 Hz guard tone |

* default

Asynchronous / Synchronous Mode Selection &M

The **&M** commands select synchronous or asynchronous operation and synchronous dial method.

The **&M** command selects asynchronous data mode.

The **&M1** command selects synchronous data mode 1. Calls are placed asynchronously. Operation switches to synchronous after connecting with the remote modem.

The **&M2** command selects synchronous data mode 2. The modem automatically dials a stored number when it detects a DTR off-to-on transition. DTR must be programmed to be active by the **&D** commands.

The **&M3** command selects synchronous data mode 3. Calls are placed manually.

The **&M4** command selects synchronous data mode 4 with V.25 bis autodialer set for Bisync protocol.

The **&M5** command selects synchronous data mode 5 with V.25 bis autodialer set for SDLC protocol.

The **&M6** command selects synchronous data mode 6 with V.25 bis autodialer set for asynchronous.

Use register *S30* to select NRZ/NRZI for data format if using SDLC.

| Command | Operation |
|---------|--------------------------------------|
| &M | Async mode (V.25 bis disabled) * |
| &M1 | Sync mode 1 (AT commands if enabled) |
| &M2 | Sync mode 2 (DTR dials if active) |
| &M3 | Sync mode 3 (manual calls) |
| &M4 | Sync mode 4 with V.25 bis bisync |
| &M5 | Sync mode 5 with V.25 bis SDLC |
| &M6 | Sync mode 6 with V.25 bis async |

* default



Caution

Synchronous terminal equipment must be available to communicate with the modem if the V.25 bis dialer is enabled.

Make / Break Dial Pulse Ratio &P

Use the **&P** command for the dial pulse to be on for 39% and off for 61% of one cycle. Use the **&P1** command for the dial pulse to be on for 33% and off for 67% of one cycle.

| Command | Operation |
|---------|---------------------------|
| &P | 39% : 61% US and Canada * |
| &P1 | 33% : 67% |

** default*

Synchronous Transmit Clock Source &X

The **&X** commands select internal, external, or receive clock as the transmit clock source.

| Command | Operation |
|---------|------------------|
| &X | Internal clock * |
| &X1 | External clock |
| &X2 | Receive clock |

** default*

V.34 Rate Selection Thresholds *TH

The ***TH** commands sets the V.34 rate selection thresholds. The V.34 modulation dynamically selects the optimum bit rate to run, based on line quality.

| Command | Operation |
|---------|-----------------------------------|
| *TH | Low threshold (10^{-6} BER) |
| *TH1 | Medium threshold (10^{-4} BER) |
| *TH2 | High threshold (10^{-2} BER) * |

** default*

V.34 Asymmetric Bit Rates *AS

The *AS command enables or disables the V.34 Asymmetric bit rate capability. This feature allows the modem to run different bit rates on the receiver and transmitter.

| Command | Operation |
|---------|-----------------------------------|
| *AS | Disable V.34 Asymmetric bit rates |
| *AS1 | Enable V.34 Asymmetric bit rates |

Modulation *MM

The *MM command sets the current modulation type to use when attempting to make a connection. Using this command automatically selects the maximum DCE speed (%B) for the selected modulation.

| Command | Operation |
|---------|--|
| *MM | Automode (typically used on dial line) |
| *MM1 | V.21 |
| *MM2 | B103 |
| *MM3 | Reserved |
| *MM4 | B212A |
| *MM5 | V.22 bis |
| *MM6 | V.27 bis 4-wire leased only |
| *MM7 | Reserved |
| *MM8 | V.29 4-wire leased only |
| *MM9 | Reserved |
| *MM10 | V.33 4-wire leased only |
| *MM11 | V.32 bis |
| *MM12 | V.34 |

Maximum DCE Speed %B

The %B commands set the originating DCE speed to follow the DTE speed. When originating a call the two modems will not connect at a speed faster than the lower DCE speed setting of the two modems. To allow the modem to transmit data at a speed different from DTE speed, enter the %Bn command where n=1 to 16.

| Command | Operation |
|---------|------------------|
| %B | Use DTE speed |
| %B1 | 300 bps |
| %B2 | 1200 bps |
| %B3 | 2400 bps |
| %B4 | 4800 bps |
| %B5 | 9600 uncoded bps |
| %B6 | 9600 bps |
| %B7 | 7200 bps |
| %B8 | 12000 bps |
| %B9 | 14400 bps |
| %B10 | Reserved |
| %B11 | 16800 bps |
| %B12 | 19200 bps |
| %B13 | 21600 bps |
| %B14 | 24000 bps |
| %B15 | 26400 bps |
| %B16 | 28800 bps* |

* default



Note

*The %B command should be used after the *MM command when specific modulations are required.*

Minimum DCE Speed %L

If the modem connects at a rate lower than the minimum DCE speed, it disconnects the link automatically.

| Command | Operation |
|---------|------------------|
| %L | Disabled |
| %L1 | Disabled * |
| %L2 | 1200 bps |
| %L3 | 2400 bps |
| %L4 | 4800 bps |
| %L5 | 9600 uncoded bps |
| %L6 | 9600 bps |
| %L7 | 7200 bps |
| %L8 | 12000bps |
| %L9 | 14400 bps |
| %L10 | Reserved |
| %L11 | 16800 bps |
| %L12 | 19200 bps |
| %L13 | 21600 bps |
| %L14 | 24000 bps |
| %L15 | 26400 bps |
| %L16 | 28800 bps |

** default*

Auto Retrain %E

This option allows the modem to automatically retrain in response to poor received signal quality without reconnecting. The modem always responds to a retrain request from the remote modem.

| Command | Operation |
|---------|-----------------------|
| %E | Disable auto retrain |
| %E1 | Enable auto retrain * |

** default*

Automatic Rate Adaption %R

Automatic rate adaption (ARA) allows the modem to automatically decrease the DCE rate when the allowable bit error rate is exceeded. If condition improves the modem automatically increases the rate.

Select this feature by front panel operation or AT command. Options include disabled (factory default), low (BER= 1 in 10^5), medium (BER= 1 in 10^4), high (BER= 1 in 10^3).

The following apply to automatic rate adaption:

- Automatic rate adaption is disabled during direct mode.
- Manual rate adaption is disabled from the front panel when automatic rate adaption is enabled.
- Only one increment or decrement in the DTE rate is allowed at a time during rate adaption from the initiating modem.
- When online, initiator rate adaption occurs a maximum of every 12 to 14 seconds from the last occurrence of a rate adaption.
- After the modem drops data rate because of poor signal quality, the line must improve by approximately 2.5 dB before an increase in rate can occur.



Note

Automatic rate adaption is disabled during direct mode.

If automatic rate adaption is enabled, the modem automatically decreases DCE rate if signal quality deteriorates beyond the allowable bit error rate. If signal quality improves, the modem increases DCE speed.

| Command | Operation |
|---------|--|
| %R | Disable automatic rate adaption * |
| %R1 | Enable automatic rate adaption using low BER: 1 in 10^5 |
| %R2 | Enable automatic rate adaption using medium BER: 1 in 10^4 |
| %R3 | Enable automatic rate adaption using high BER: 1 in 10^3 |

* default

Manual Rate Adaption *RR

The **RR* command forces the modem to re-adapt the DCE rate with the remote modem.

| Command | Operation |
|---------|------------------------|
| *RR | Rate adaption to 2400 |
| *RR1 | Rate adaption to 4800 |
| *RR2 | Rate adaption to 7200 |
| *RR3 | Rate adaption to 9600 |
| *RR4 | Rate adaption to 12000 |
| *RR5 | Rate adaption to 14400 |
| *RR6 | Rate adaption to 16800 |
| *RR7 | Rate adaption to 19200 |
| *RR8 | Rate adaption to 21600 |
| *RR9 | Rate adaption to 24000 |
| *RR10 | Rate adaption to 26400 |
| *RR11 | Rate adaption to 28800 |

Product Revision Level %V

The *%V* command displays the product revision level.

Online Quick Reference \$H

The *\$H* command displays an AT command set quick reference. The <return> key terminates the page displays and any other key scrolls through the pages.

| Command | Operation |
|--------------|---|
| \$H | Displays online quick reference |
| \$H=<string> | Search online quick reference for string. |

Product Serial Number \$V

The *\$V* command displays the product serial number.

Permissive / Programmable %Z

For dial-up operation the modem transmitter output can be set in two different modes of operation. In permissive (RJ11 jack), transmit output level is set to -9 dBm. To set the modem for permissive mode enter the %Z command. In programmable (RJ45 jack) operation, the transmit level is set by an external program resistor. This mode is selected with %Z1.

| Command | Operation |
|---------|---------------------|
| %Z | RJ11 (permissive) * |
| %Z1 | RJ45 (programmable) |

* default



Note

Selecting programmable jack (RJ45) without a programmable jack causes the transmit level to be -12 dBm.

Talk / Data *DA

The *DA commands select talk or data mode.

| Command | Operation |
|---------|--------------------------|
| *DA | Switches modem to talk * |
| *DA1 | Switches modem to data |

* default

V.32 Fast Train *FT

The V.32 fast train option is used to reduce training time when operating over high quality, limited distance dial or 2-wire leased lines.

| Command | Operation |
|---------|----------------------|
| *FT | Disable fast train * |
| *FT1 | Enable fast train |

* default

Incoming Call *IC

The *IC command causes the modem to disregard an incoming call.

Line Current Disconnect *LC

Dial line operation only. The modem can be configured to disconnect upon loss or interruption of telephone line current.

| Command | Operation |
|---------|--|
| *LC | Line current disconnect off |
| *LC1 | Line current disconnect short (8 ms) |
| *LC2 | Line current disconnect long (90 ms) * |

* default

Disable AT Command Set *NT

The *NT command disables the AT command set.

The *NT1 command allows the user at a remote modem to enable AT command operation of another modem via remote configuration.

| Command | Operation |
|---------|--|
| *NT | Disable AT command set |
| *NT1 | Enable AT command set at remote site * |

* default

If the AT command set of a local modem is accidentally disabled and must be recovered locally, alternate power on and off seven times. The time that power is on must be greater than 1 second but less than 5 seconds. This process loads factory set 1 as the powerup configuration, enabling the AT command set.

Dial Line Transmit Level *TDn

| Command | Operation |
|---------|--|
| *TDn | Sets dial line TX level to <i>n</i> where <i>n</i> is a number 9 through 30 corresponding to a TX level of -9 to -30 dBm |

PRIVATE LINE OPERATION



Note

*For a 2- or 4-wire leased line connection to succeed one modem must be configured as forced answer and the other modem as normal originate. Both modems should have only one protocol, MNP or LAPM, enabled and **PROTOCOL FALLBACK** must be disabled. DCE line speed must be the same for both modems.*

4-Wire Operation

In 4-wire operation, the modem is a full-duplex, leased-line modem requiring a dedicated 4-wire leased line. Only point-to-point dedicated leased lines are supported. The 4-wire leased line connects to the AUX jack on the modem rear panel. Dialing is not necessary. When connected via leased line the modems will train and begin communicating with each other. The LINE jack can be used to connect a 2-wire dial-up line for dial backup.



Note

The V3229, V3227, V3225, and V3257 modems use V.33 as the modulation type. The V.3400 must be set up to V.33 to connect to these modems.

2-Wire Operation

In 2-wire operation, the modem is a full-duplex modem able to operate over 2-wire leased or PSTN lines.

2-wire Leased Line Operation:

The 2-wire leased line is connected to the AUX jack; the LINE jack connects to a 2-wire dial-up line for dial backup. The leased line connects the local and remote modems directly and dialing is not necessary. One of the modems must be configured for forced answer and the other for normal originate. When connected via leased line the modems will connect and begin communicating with each other.

The **&L** command is used to select Private Line (leased line) operating mode. The ***OR** commands selects the origination or answer mode when operating in the leased line configuration.

**Note**

DTR must be held high in 2-wire or 4-wire leased line operation. This is accomplished by DTE control, wiring pin 20 of the digital interface cable high, or by selecting the option, IGNORES DTR. If DTR is terminal controlled, loss of synchronization can be corrected by cycling DTR. This causes the modem to initiate the 2-wire training sequence. DSR goes off during the training procedure.

2-wire Dial-up Operation:

Connection to the telephone network is through the LINE jack. A standard telephone can be connected to the AUX jack for manual dialing.

Dial Backup

Dial backup allows the modem to switch to a dial backup mode if the data connection on the leased line is unacceptable for communications. This can be accomplished in two ways:

- Automatic - backup due to extended loss of carrier or 4 unsuccessful retrains in 3 minutes
- Manual - user determined using front panel controls or AT commands

**Caution**

In leased line operation, if both units have autodial backup enabled, one must be configured for forced answer. This prevents both units from dialing if the leased line fails.

Both methods will cause the modem to dial the prestored autodial number. The originate modem will wait for 5 seconds and then initiate the call. The answer modem will wait for a ring. The modems then train and begin communicating over the dial-up line. If the dial connection is unsuccessful after three attempts, a retrain on the leased line will be initiated.

In manual mode, the return to leased line is only done when commanded. In automatic mode the return to leased line is initiated after the lookback time in register S28 has elapsed. To prevent unnecessary termination of the dial line connection, a leased line lookback test is performed. If the leased line is not acceptable, the dial connection is resumed with a retrain. If the leased line is acceptable, the dial connection is dropped and normal leased line mode is resumed.

When the unit attempts to return to leased line, the LCD displays LEASE LOOKBACK. If the leased line has been restored to service, data can be passed approximately 10 seconds after LEASE LOOKBACK was initiated. The LCD will continue to display LEASE LOOKBACK for slightly more than a minute. During this time the dial line connection is maintained if a return to dial line operation is required. When the LCD displays ON LINE again the dial line is disconnected.



Note

A diagnostic test initiated during dial backup mode terminates when the modem performs a leased line lookback.

Dial / Leased Line &L

&L selects line operation as required:

| Command | Operation |
|---------|-------------------------|
| &L | Dial (switched) * |
| &L1 | Leased (private) 2-wire |
| &L2 | Leased (private) 4-wire |

* default

Dial Backup *DB

| Command | Operation |
|---------|---------------------------------|
| *DB | Manual dial backup operation * |
| *DB1 | Automatic dial backup operation |

** default*

Return to Leased Line from Dial Backup *LB

During dial backup operation, *LB causes the modem to return to leased line operation.

During leased line operation with forced answer enabled, *LB causes the modem to wait for a dial backup call.

Manual Dial Backup *LD

*LD dials the autodial number if the modem is in originate mode with manual dial backup selected. Leased line operation only.

Answer / Originate *OR

*OR forces the modem to answer or originate mode. This option is used during 2- and 4-wire leased line operation with error correction and/or dial backup.

| Command | Operation |
|---------|-------------------|
| *OR | Force originate * |
| *OR1 | Force answer |

** default*

Leased Line Transmit Level *TLn

| Command | Operation |
|---------|---|
| *TLn | Sets leased line TX level to <i>n</i> where <i>n</i> is a number 0 through 30 corresponding to a TX level of 0 to -30 dBm |

CONFIGURATION COMMANDS

These commands recall various profiles for insertion into the active profile, store the active profile and telephone numbers in nonvolatile memory, and designate the powerup profile. Remote configuration is discussed at the end of this section.

CONFIGURATION PROFILES

Modem operations are controlled by option settings selected from factory defaults stored in ROM, active settings stored in RAM, and custom settings stored in nonvolatile memory. These three code storage locations are called profiles.

Active Profile

The active profile holds the current option settings and is used by the modem for all operations and functions. Any active profile option can be changed to meet an immediate requirement. The active profile is maintained in volatile memory referred to as S-registers.

Stored Profile

When an active configuration is established that meets all operating requirements, it can be transferred to one of the stored profiles. Two stored profiles are available for greater versatility.

If the active profile has been temporarily changed it can be reset to either of the stored profiles with the *Z* command. The *&Y* command selects one of the two stored profiles to be the powerup profile.

Factory Profile

The factory configurations are stored in ROM and cannot be changed by the user; they can be transferred to the active profile and then modified to fit a specific application if needed. The *&F* command recalls one of the nine factory configurations.

Storing a Configuration &W

The &W commands store the current configuration options in one of two nonvolatile memory locations (Figure 5-1). The stored configurations are retained in memory even when power is off, or until &W is issued with a new configuration options with a single command.

| Command | Operation |
|---------|--------------------------------------|
| &W | Store options to user option set 1 * |
| &W1 | Store options to user option set 2 |

* default

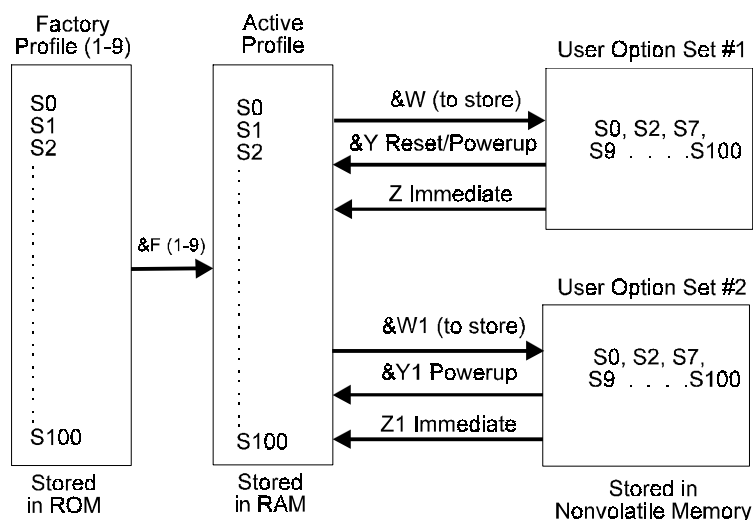


Figure 5-1 Configuration Storage and Recall

Powerup Option Set &Y

The &Y command determines which user option set is loaded during powerup and reset.

| Command | Operation |
|---------|--|
| &Y | Powerup with user option set 1 * |
| &Y1 | Powerup with user option set 2 |
| &Y? | Displays currently selected powerup option set |

* default

Load Factory Options &F

The &Fn command loads one of the existing configuration sets, providing a complete configuration for a compatible system/network environment. Refer to Appendix E for a complete list of the options in each set.

| Command | Operation |
|---------|---|
| &F, &F1 | Load factory option set 1 (async dial-up with V.42 bis) * |
| &F2 | Load factory option set 2 (async dial-up without V.42 bis) |
| &F3 | Load factory option set 3 (sync dial-up without V.42 bis) |
| &F4 | Load factory option set 4 (sync 4-wire leased line without V.42 bis) |
| &F5 | Load factory option set 5 (async 4-wire leased line with V.42 bis) |
| &F6 | Load factory option set 6 (async 4-wire leased line without V.42 bis) |
| &F7 | Load factory option set 7 (sync 2-wire leased line normal originate) |
| &F8 | Load factory option set 8 (sync 2-wire leased line forced answer) |
| &F9 | Load factory option set 9 (sync V.25 bis dialer) |

* default

Reset to Stored Configuration Z

The Z commands reset the modem and immediately load either user option set 1 or 2 as the current configuration. This command saves time once a proven configuration is established.

| Command | Operation |
|---------|---|
| Z | Resets the modem and immediately loads user option set 1* |
| Z1 | Resets the modem and immediately loads user option set 2 |

* default

View Configuration Profiles / Received Signal Options &V

This command allows the user to view the current configuration profile in the form of S-register values. &V1 displays the received signal options.

| Command | Operation |
|---------|-----------------------------------|
| &V | Displays configuration profiles * |
| &V1 | Displays received signal options |
| &V2 | Displays active profile |

* default

Storing a Telephone Command Line &Z, (*CN_x,n), *ND

Nine stored phone number locations of up to 31 characters each are available in nonvolatile memory. Normally, one phone number per location is accommodated. However, a phone number longer than 31 characters can overflow into the next location. Any spaces remaining in the overflowed location cannot be used for another number. The stored phone number is retained until replaced by another number. Modem power can be turned off without affecting stored information.

Two commands can store phone numbers:

- &Z inserts a phone number in location one only.
- *CN inserts phone numbers in locations one through nine.

To store a telephone command line in location one enter the &Z command followed by the desired command sequence of digits and modifiers.

AT &Z 554-1212

In this example the command sequence to dial the indicated number is stored at location 1 for later dialing.



Note

Neither the AT prefix nor the D command should follow the &Z.

&Z*n* - Stores telephone number *n*, including dial modifiers, at location 1 (up to 31 digits).

*CN*x,n* - Stores telephone number *n*, including dial modifiers, at location *x* (*x*=1 to 9).

*CN*x*, - Clears telephone number location *x*

*ND - Displays the stored numbers (1-9).

Retaining / Restoring Options *RO

This option is used when the modem is shared by two or more DTEs.

When options are retained, the current configuration is not altered at disconnect. With options restored, the modem returns to the previously stored configuration on disconnect.

When options are restored at disconnect, the following commands return OK but are not executed:

*CN Store telephone number
&Z Store telephone number
&F Recall factory configuration
&W Store current configuration

| Command | Operation |
|---------|--------------------------------|
| *RO | Retain options at disconnect * |
| *RO1 | Restore options at disconnect |

* default

REMOTE CONFIGURATION

This mode of operation allows viewing or modifying the options of a remote modem that supports Motorola UDS remote configuration. Remote configuration is performed using the front panel LCD or more commonly AT commands from the local terminal. Remote configuration is initiated by the local (master) modem through a proprietary protocol, a security code, and an acknowledgment from the remote (slave) unit to be modified. The security code is user inserted and provides protection from unauthorized entry. The modems are shipped from the factory without a security code.



Note

Remote configuration is supported at all rates except 300 bps.

Remote Configuration Security

The correct security code must be received by the remote modem before remote configuration can be established. Once established, the local DTE becomes a virtual terminal and can serve both local and remote modems. After starting remote configuration, the local DTE serves the remote modem.

To return DTE service to the local modem while in remote configuration, issue the +++ escape sequence.

DTE service can again be returned to the remote modem by issuing the *O* command. Switching DTE service between local and remote modems may be performed as needed.

To exit remote configuration, return DTE service to the local modem. The *&T* command will exit remote configuration mode.

Remote configuration may be entered immediately after dialing by placing the remote configuration command (*%T=*), without the = sign and followed by the security code, at the end of the dial string.

Remote Security Code %P=

A security code prevents unauthorized access to remote configuration mode. This code is separate from low and high security passwords, which are discussed under Security in the next section. The security

code is user programmable and can be set to any value from a single 0 to any combination up to 99999999 using the *%P=(desired code)* command.

Example: If the remote modem security code is *12345*, the local modem must include this code in the initialization string before the remote modem responds.

| Command | Operation |
|------------|--|
| %P= | Sets security code to a value 0 to 99999999 entered after the equal sign |
| %P? | Requests local security code to be displayed |
| %P=D | Access for remote configuration is not possible when security code is disabled |
| %P=(blank) | Clears security code * |

* default

The *%P=D* command disables remote configuration. To enable remote configuration, insert another security code.

Entering Remote Configuration %T=, &T

This mode of operation allows the modem user to view or modify the option set of a compatible remote modem. Enter the *%T= (security code of remote)* command to initiate remote configuration.

The modem is shipped from the factory with security code *(blank)*. This allows remote configuration by using *(blank)* as the security code.

| Command | Operation |
|---------|---|
| %T= | This command followed by the correct security code establishes remote configuration |
| &T | Exits remote configuration |

Remote Configuration can also be specified by the dial command by placing *%T (password)* after the dial digits (the equal sign is left off).

Example: *ATD 555-1212%T01234*

Chapter 6 Protocols

CCITT V.42 BIS ERROR CONTROL PROTOCOL

V.42 bis is an industry standard for error control adopted by the Consultative Committee for International Telephone and Telegraph (CCITT). The CCITT V.42 bis protocol incorporates two error control algorithms, LAPM and MNP. LAPM is a CCITT Link Access Protocol family member related to LAPB and LAPD currently in use in other communications applications. MNP is Microcom Networking Protocol that has become an industry standard by the number of its users.

The use of V.42 bis requires both local and remote modems to be V.42 bis compatible. Error control protocol is transparent to the user and requires no special hardware or software. Data to be transmitted is put in a buffer so the modem can retransmit it if an error occurs. The modem also buffers data received from the remote modem in case an error occurs and the data is retransmitted. To avoid overfilling the buffer, flow control is used to control data between the modem and the terminal. V.42 bis protocol options can be set by AT commands.



Note

Error control protocols are only valid when using asynchronous DTE options.

RELIABLE

When a LAPM or MNP link is established the modem is in reliable mode. V.42 bis allows negotiation with a remote modem to the highest level of protocol common to both units. Both LAPM and MNP control data errors by retransmitting any block of data that was corrupted in transit. LAPM is assigned highest priority and if not supported, then an MNP connection is attempted.

AUTO-RELIABLE

In auto-reliable mode the modem negotiates to the highest protocol (LAPM or MNP) common to both modems. However, if a reliable connection cannot be established, auto-reliable allows the protocol to fallback to normal mode.

CONSTANT SPEED INTERFACE

The modem serial port adapts to the data rate of the DTE and does not change speed if the (modem) data link connects at another speed. Therefore the DTE to DCE interface speed is constant.

DATA COMPRESSION

Using MNP Class 5 data compression, the modem can achieve data throughput approaching 28800 bps. With LAPM data compression, the modem can achieve data throughput approaching 115200 bps. This increase in speed is achieved by automatically analyzing the data stream and reducing the number of bits required to represent the characters. 100% error-free transmission is assured by the application of the MNP or LAPM error control protocol on the compressed data.

Compression takes place only if the modem detects that the remote modem supports compression. If not, a reliable connection is made without compression.

Although data compression is compatible with any type of data, it is most efficient for ASCII text files. For maximum throughput when using data compression, the terminal should be set to a higher speed than the connect speed with the constant speed interface on and flow control enabled. When transmitting or receiving data files in one direction, the throughput can be increased for V.42 bis by having extra buffer and more processor time with the %C2 and %C3 data compression commands.

NORMAL MODE

No error control with or without constant speed DTE interface. Data is buffered.

DIRECT MODE

The DTE speed and DCE speed are forced to be the same. No error control or buffering.



Note

In direct mode and the DCE link is established at a rate other than the original DTE speed, the modem will issue the connect message for the new DTE speed at the original rate. All subsequent data will be sent to the DTE at the new DCE speed.

FLOW CONTROL

If the serial port speed exceeds that of the modem connection, characters may be sent by the DTE to the modem faster than it can send them to the remote modem. The modem holds characters in an internal buffer until they can be transmitted. When this buffer is full, the modem uses flow control to cause the DTE to stop sending characters. As the modem continues to transmit data and the buffer empties, flow control is again used to cause the DTE to resume sending data. The modem can use hardware flow control (RTS/CTS) or in-band flow control (XON/XOFF).

PROTOCOL COMMANDS

These commands enable or control the various data compression, flow control, and error correction options of the modem. Table 6-1 illustrates mode and the associated features.

Table 6-1. Operating Modes and Conditions

| Operating Mode | Error Correction | Data Compression | Flow Control | Data | Constant Speed Interface |
|------------------------------|------------------|------------------|----------------|--------------|--------------------------|
| Normal | Disabled | Not applicable | Allowed | Buffered | On or off |
| Direct | Disabled | Not applicable | Not applicable | Not buffered | DTE=DCE (slaved) |
| Reliable (MNP and LAPM) | Enabled | On or off | Allowed | Buffered | On |
| Auto-reliable (MNP and LAPM) | Enabled | On or off | Allowed | Buffered | On |

Disconnect Buffer Delay %D

Select a delay during which the modem processes data in its transmit and receive buffers before disconnecting. When a condition exists which causes a disconnect, the modem tries for n seconds to empty its buffers. When the buffers are empty or if $n=0$, the modem disconnects immediately.

| Command | Operation |
|---------|--|
| %D | Disconnect buffer delay disabled * |
| %Dn | Disconnect buffer delay value ($n = 1-255$ seconds) |

* default

Serial Port (DTE) Constant Speed \J

The \J command allows DCE and DTE to operate at different speeds. The \J1 command forces serial port (DTE) speed to follow data link speed in any mode.

If the modem is in direct mode (\J1) and a DCE link is established at a speed other than that of the original DTE autobaud speed, the modem will issue the CONNECT message for the new DTE speed at the original rate. All subsequent data will be sent to the DTE at the new DCE speed.

| Command | Operation |
|---------|---|
| \J | Disable slaved DTE/DCE (constant speed DTE on)* |
| \J1 | Enable slaved DTE/DCE (constant speed DTE off) |

* default

V.42 Optional Detection Phase \M

This is a data sequence that speeds up the LAPM link negotiation time if V.42 LAPM is supported by the remote modem.

| Command | Operation |
|---------|--|
| \M | V.42 fast detect data sequence disabled |
| \M1 | V.42 fast detect data sequence enabled * |

* default

Operating Mode \N

Select the V.42b mode to be used in data mode. An \Nn command issued during command mode while a connection is in progress will not affect the current connection but will be acted on for subsequent connections. LAPM or MNP protocol operation is referred to as MNP-only mode, and the auto-reliable modes allow protocol fallback.

| Command | Operation |
|---------|---|
| \N | Normal mode — no error control; data buffered |
| \N1 | Direct mode — no error control; data not buffered |
| \N2 | MNP only — try MNP; disconnect if not successful |
| \N3 | MNP or normal — try MNP; fallback to normal async |
| \N4 | LAPM only — try LAPM; disconnect if not successful |
| \N5 | LAPM or normal — try LAPM; fallback to normal |
| \N6 | LAPM or MNP — try both protocols; disconnects if not successful |
| \N7 | LAPM, MNP, or normal — try both protocols; fallback to normal if not successful * |

* default

Auto-Reliable Fallback Character %An

Select the ASCII character to be recognized as the auto-reliable fallback character by the answering modem. During negotiation of protocol in auto-reliable mode, the answering modem switches from reliable to normal mode when receiving the auto-reliable fallback character from the calling modem and passes the character to the serial port.

Enter the %An command to set the auto-reliable fallback character (n=1-27 decimal representing an ASCII character).

| Command | Operation |
|---------|---|
| %A0 | Disable auto-reliable fallback character * |
| %An | Sets ASCII character to be recognized as the auto-reliable fallback character |

* default



Note

The modem must be set for auto-reliable mode (AT\N3, \N5, \N6, \N7).

Serial Port Flow Control \Q

The \Q commands set the type of flow control used by the serial port. If the serial port speed exceeds that of the modem connection, characters may be sent by the DTE to the modem faster than it can send them to the remote modem. The modem holds characters in an internal buffer until they can be transmitted. When this buffer is full the modem uses flow control to stop data from DTE. As the modem continues to transmit data and the buffer empties, flow control is again used to cause the DTE to resume sending data.

The \Q - \Q3 commands affect both DTE and DCE flow control.

The \Q4 - \Q7 commands affect only flow control by the DCE.

The \Q command disables flow control bilaterally.

When the \Q1 command is used, the modem generates and accepts XON/XOFF characters to start and stop the data flow. These characters have the same parity as the DTE setup taken from the last AT command.

When the \Q2 command is used, the modem uses CTS off to stop the data from the DTE and CTS on to restart it.

When the \Q3 command is used, the modem uses CTS off to stop the data from the DTE and CTS on to restart it. The DTE uses RTS off to stop data from the modem and RTS on to restart it.

The \Q4 command disables flow control by the DCE.

The \Q5 command enables XON/XOFF flow control by the DCE only.

The \Q6 and \Q7 commands force the modem to use RTS off to stop data from the modem and RTS on to restart it. This does not effect DTE flow control.

| Command | Operation |
|---------|---|
| \Q | Disable bilateral flow control |
| \Q1 | Enable bilateral XON/XOFF flow control * |
| \Q2 | Enable DTE CTS flow control, disable DCE flow control |
| \Q3 | Enable CTS/RTS bilateral flow control |
| \Q4 | Disable DCE flow control |
| \Q5 | Enable DCE XON/XOFF flow control * |
| \Q6 | Enable DCE RTS flow control |
| \Q7 | Enable DCE RTS flow control |

* default

XON/XOFF Pass Through \X

This option is active when flow control of the modem by the DTE has been selected for XON/XOFF and the connect mode is MNP-only or normal. It enables or disables the sending of local flow control characters (XON/XOFF) to the remote modem as well as being acted on in the local modem. In MNP-only mode the modem treats incoming XON/XOFF characters from the remote modem as data characters. In normal mode the modem will look at the \G command and act accordingly.



Caution

With \X1 in effect local flow control characters will be sent to the remote system. These characters may turn on the data flow from the remote system before the modem is ready to receive more data, possibly resulting in data loss.

| Command | Operation |
|---------|---|
| \X | Process but do not pass XON/XOFF characters to remote DCE * |
| \X1 | Process and pass XON/XOFF characters to remote DCE |

* default

Data Link Flow Control \G

This flow control paces data from the remote modem to the local modem during a normal connection. When the \G/ command is sent, the modem uses XON/XOFF to start/stop data transmission from the remote modem. This command is ignored during an MNP connection.

| Command | Operation |
|---------|----------------------------------|
| \G | Disable data link flow control * |
| \G1 | Enable data link flow control |

* default



Note

The V.3400 will transmit the XON/XOFF characters to start/stop data transmission from the remote modem. The V.3400 will not respond to the XON/XOFF characters. This is to insure that a false XON/XOFF is not detected resulting data loss.

Break Control \Kn

Use \Kn ($n = 0-5$) to indicate the action taken by the modem when a break is encountered.

| Command | Operation |
|---------|------------------|
| \K | Break option 0 |
| \K1 | Break option 1 |
| \K2 | Break option 2 |
| \K3 | Break option 3 |
| \K4 | Break option 4 |
| \K5 | Break option 5 * |

* default

Conditions under which breaks may occur are explained below with descriptions of the modem's response under the different \K command break options.

A break is sent to the serial port while the modem is in *connect state* during an *reliable* or *normal connection* (no protocol, data buffered).

| Command | Operation |
|----------------|--|
| \K, \K2, \K4 | Enter command mode but do not send break to the remote modem |
| \K1 | Empty the data buffers and send break to the remote modem |
| \K3 | Immediately send break to the remote modem |
| \K5 | Send break to the remote modem in sequence with any data received from the serial port |

A break is sent to the serial port while the modem is in *connect state* during a *direct connection* (no protocol, data not buffered).

| Command | Operation |
|----------------|---|
| \K, \K2, \K4 | Immediately send break to the remote modem and enter command mode when break is through |
| \K1, \K3, \K5 | Immediately send break to the remote modem |

A break is received from the remote modem while the modem is in *connect state* during a *normal connection* (no protocol, data buffered).

| Command | Operation |
|----------------|--|
| \K, \K1 | Empty the data buffers and send break to the serial port |
| \K2, \K3 | Immediately send break to the serial port |
| \K4 , \K5 | Send break to the serial port in sequence with any data received from the remote modem |

A transmit break command is issued while the modem is in *command state* during a *reliable* (protocol) or *normal connection* (no protocol, data buffered).

| Command | Operation |
|----------|--|
| \K, \K1 | Empty data buffers and send break to the remote modem |
| \K2, \K3 | Immediately send break to the remote modem |
| \K4, \K5 | Send break to the remote modem in sequence with any data received from the serial port |

Inactivity Timer \T

The \T command specifies the number of minutes the modem will stay online without transmitting or receiving data before hanging up. When the value is set to 0, the timer is disabled.

| Command | Operation |
|---------|---------------------------------------|
| \T | Disable inactivity timer * |
| \Tn | Set inactivity to n (n=1-255) minutes |

* default

Maximum Reliable Block Size \A

The \A command sets the maximum transmit block size for MNP connections. Use this command to force the modem to transmit smaller blocks in an MNP connection. A smaller block size maximizes throughput when marginal line conditions are causing errors. The modem sends a block up to the size specified by the \A command.

| Command | Operation |
|---------|--|
| \A | Maximum transmit block size = 64 characters |
| \A1 | Maximum transmit block size = 128 characters |
| \A2 | Maximum transmit block size = 192 characters |
| \A3 | Maximum transmit block size = 256 characters * |

* default

Transmit Break / Set Break Length \B

The \B commands tell the local modem to send a break signal to the remote modem. In all modes except direct, S79 determines the length of the break sent to the DTE by the modem receiving a break signal over the link. S79 may be set directly or via \Bn where n=1-255 in 20 ms increments. The default is 35 (700 ms).

| Command | Operation |
|----------------|--|
| \B | Sends a break signal to the remote modem (does not modify S79) * |
| \Bn | Sets S79 to length of break desired; n=1-255 in 20 ms increments; default= 35 (700 ms) |

* default

Set Auto-Reliable Buffer \C

This determines whether or not a modem in reliable mode will buffer data received from a modem that is not in reliable mode during the 4 seconds in which the modems try to establish a reliable link. Use these commands when the modem is in the auto-reliable mode and is expected to process a call from a modem not in a reliable mode.

| Command | Operation |
|----------------|---|
| \C | Disable auto reliable data buffer * |
| \Cn | Buffer data for 4 seconds or 200 characters |

* default

V.42bis Data Compression %C

The %C command determines application of data compression while running LAPM protocol.

| Command | Operation |
|----------------|--|
| %C | Data compression disabled |
| %C1 | Enabled on transmit and receive data * |
| %C2 | Enabled on transmit data only (enhanced compression) |
| %C3 | Enabled on receive data only (enhanced compression) |

* default

Chapter 7

Test Mode Operation

GENERAL

Diagnostic tests are used to isolate faults in the communications path. Diagnostic tests will terminate after the period of time specified by *S18*. If *S18* is set to 0, the timer is disabled and tests will run continuously. Tests may also be terminated by the *&T* command. When in test modes without test pattern, issue the escape sequence +++ to return to command mode before terminating the test with the *&T* command.



Note

Local analog loopback with or without test pattern is the only test available in protocol mode.

Test Categories

Diagnostic tests fall into two categories: those with test patterns and those without. Refer to Table 7-1.

Table 7-1. Test Operating Mode Requirements

| Test | Offline | Online |
|---|---------|--------|
| LAL (Local Analog Loopback) | X | X |
| LAL/TP (Local Analog Loopback with Self Test) | X | X |
| LDL (Local Digital Loopback) | | X |
| RDL (Remote Digital Loopback) | | X |
| RDL/TP (Remote Digital Loopback with Self Test) | | X |
| TP (Test pattern) | | X |



Note

These tests do not apply to fax mode and should only be performed when the modem is configured for data operation.

LDL, RDL, and RDL/TP tests are initiated after making an online data connection in normal or direct mode only. LAL and LAL/TP are initiated while in offline command mode. These tests can be initiated by AT commands or by using the LCD front panel SELECT TEST menus. Refer to Table 7-2.

Table 7-2. Test Commands

| Command | Operation |
|---------|---|
| &T | Terminate any test |
| &T1 | Initiate local analog loopback test |
| &T3 | Initiate local digital loopback test |
| &T4 | Grant remote requested digital loopback * |
| &T5 | Deny remote requested digital loopback |
| &T6 | Initiate remote digital loopback test |
| &T7 | Initiate remote digital loopback with test pattern |
| &T8 | Initiate local analog loopback test with test pattern |
| %T | Transmit test pattern |

* default

Terminating a Test in Progress &T

Tests can be terminated manually or automatically. The &T command terminates a test manually. The modem automatically goes to command mode during LDL, LAL/TP, and RDL/TP tests. Enter the &T command to terminate the tests.

For LAL and RDL, enter the escape sequence before the &T command to go to the command mode.

By preloading register S18 with 1 to 255, each test mode automatically times out after the specified number of seconds and exits back to the command mode. Loading S18 with 0 disables the auto timeout feature and the test will run continuously until manually terminated.

For example:

To Run the self test analog loopback test for 30 seconds
Enter ATS18=30&T8

The modem should respond with 000 after 30 seconds.

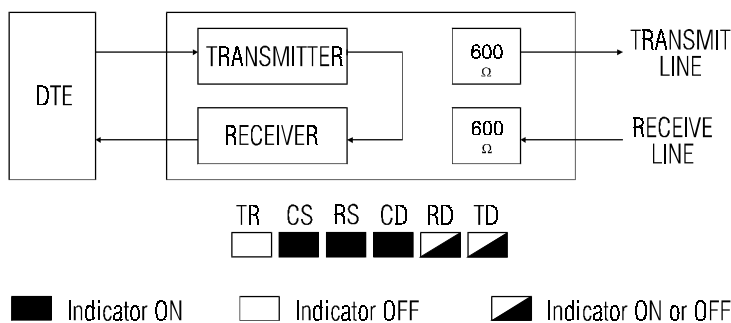
TESTING THE LOCAL MODEM

Test local operation with the modem offline in command mode. Use LAL and LAL/TP to test the local modem and the communications to the local DTE.

Local Analog Loopback & T1

In Local Analog Loopback the modem transmitter connects to its receiver so the analog signal normally sent over the telephone line is received locally.

If operating on leased lines, the lines are terminated into 600 ohms (Table 7-1). If off hook on a dial-up line, the modem is forced on hook.



**Figure 7-1 Local Analog Loopback
(4-Wire Operation and 2-Wire Operation)**

For 2-wire operation, Analog Bilateral Loopback is invalid. In 4-wire operation, Analog Bilateral Loopback connects the receive line to the transmit line through a buffer amplifier.



Note

Figures 7-1 through 7-5 include LED test indications.

These indications are valid when DTE options are set by factory option set #1 and RTS is active from the DTE.

Where indicated, RD and/or TD may be on, off, or flashing depending on the type of DTE and its operating state.

Test the local DTE and cable by entering the `&T1` command. Enter a test message and verify it is echoed on the screen. If the message is not returned exactly as entered, the terminal equipment or data cable is at fault.

To determine if the data cable is defective replace it with a properly configured cable with electrical continuity. If the cable checks out but the problem remains, the DTE is defective.

If all local equipment checks out, proceed to the Testing the Remote Modem section in this chapter.

Issue an escape sequence followed by `&T1` to exit analog loopback.

Local Analog Loopback with Self Test &T8

When the modem is offline in command mode, enter the `&T8` command to put the modem in self test local analog loopback (Table 7-2).

The modem transmits a test pattern. The test pattern is looped back to the receiver and checked for errors. Entering the `&T` command causes the modem to exit self test analog loopback. The modem responds with a three digit value between 0 and 255 representing the number of errors during test pattern detection. If errors occur, repeat the test to verify the consistency of the problem.

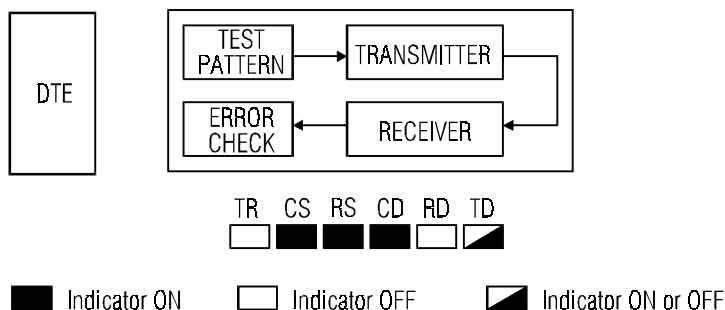


Figure 7-2 Local Analog with Test Pattern

TESTING THE REMOTE MODEM

Use LDL, RDL, and RDL/TP in the online data mode to test the remote modem and phone line. Enter the escape sequence after making a connection to return to command mode. The appropriate test command, *&T3*, *&T6*, or *&T7*, can then be entered to initiate an online test.

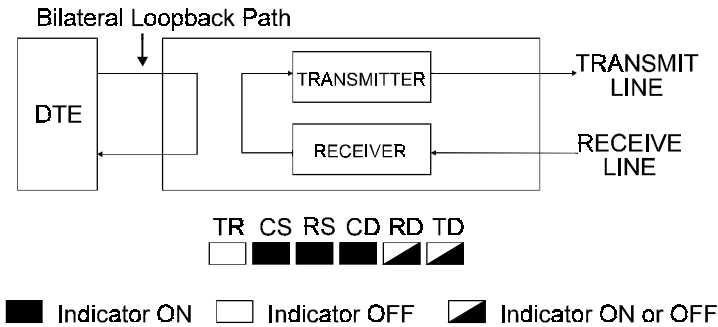
Local Digital Loopback &T3

After making the data connection, enter the escape sequence to return to command mode. Entering *&T3* puts the local modem in digital loopback. The remote operator can now send a test message which is looped back to the remote terminal screen.

If the test timer (*S18*) was loaded before issuing the *&T3* command the local modem exits the test after the specified number of seconds and returns to command mode. If not, enter *&T* to exit the test. Enter the command to return to online data mode.

The local modem receiver connects to its transmitter so received data is retransmitted to the remote site.

If Digital Bilateral Loopback is enabled locally, the local DTE is looped back to itself (Table 7-3). If disabled, the local DTE receives a constant mark.



**Figure 7-3 Local Digital Loopback
with Bilateral Loopback Enabled**

Grant/Deny RDL Request &T4, &T5

Local operators can deny a request from the remote modem for remote digital loopback.

To Allow your modem to be placed in RDL by a remote operator

Enter AT&T4

To Prevent your modem from entering RDL

Enter AT&T5

Remote Digital Loopback &T6

The initiating modem signals the remote modem to go to Digital Loopback. The remote modem receives and then retransmits data back to the local modem. If Digital Bilateral Loopback is enabled on the remote modem, the remote DTE is looped back to itself (Figure Table 7-4).

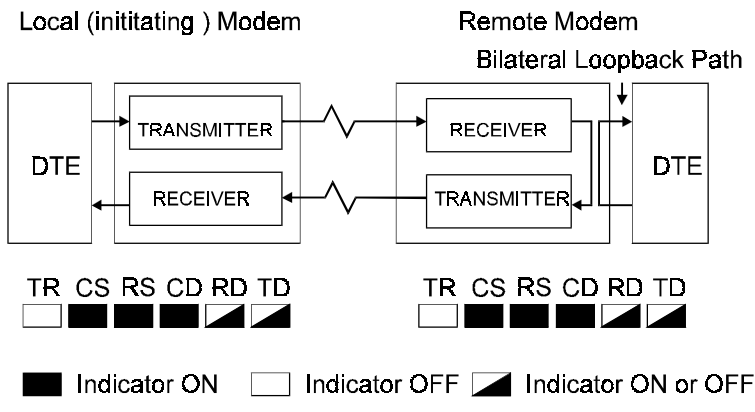


Figure 7-4 Remote Digital Loopback with Digital Bilateral Loop Enabled at the Remote Site

After making the data connection, enter the escape sequence to return to command mode. Entering *&T6* places the remote modem in digital loopback provided the remote operator enters the *&T4* command to allow an RL request. Enter a test message and verify the message is being looped back to your terminal screen. If the message is incorrect, use the analog loopback tests on both modems to isolate the problem. If both modems run analog loopback without errors, the problem could be with the phone line.

Remote Digital Loopback with Self Test &T7

After making the data connection, enter the escape sequence to return to command mode. Entering *&T7* places the remote modem in digital loopback provided the remote operator enters *&T4* to allow an RL request. Once in RDL/TP, the local modem transmits a test pattern and

automatically verifies that the remote modem is looping the pattern back (Table 7-5). Enter *&T* to exit RDL/TP and return to command mode. Enter the *O* command to return online in data mode.

Exiting RDL/TP the modem responds with a three digit value between 0 and 255 representing the number of errors which occurred during test pattern detection. If errors occurred repeat the test several times to verify the consistency of the problem, then use the analog loopback tests to isolate the problem.

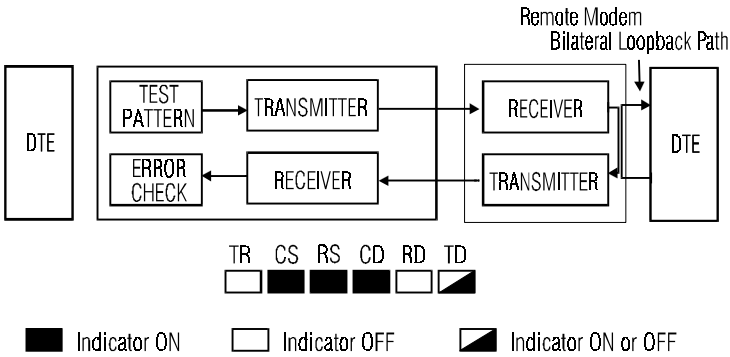


Figure 7-5 Local Modem Initiating Remote Digital Loopback with Test Pattern

Test Pattern %T

In Test Pattern, transmit data from the local DTE is blocked and replaced by a V.52 compatible test pattern. When the modem transmits the test pattern, it expects to receive the same pattern.

Bilateral Test Enable / Disable *DG

Enable or disable bilateral test functions.

| Command | Operation |
|---------|-----------------------------------|
| *DG | Bilateral digital loop disabled * |
| *DG1 | Bilateral digital loop enabled |

* default

DTE Controlled Remote Digital Loopback (Pin 21) *RD

To enable DTE controlled remote digital loopback, enter **RD1*.

Enabled, the modem goes into remote digital loopback when it detects an off-to-on transition of pin 21 while in the online data mode. Test ends when it detects an on-to-off transition of pin 21 and then returns to online data mode. To disable this function enter the **RD* command.

| Command | Operation |
|---------|----------------------|
| *RD | Ignore pin 21 * |
| *RD1 | RDL enabled (pin 21) |

* default

**Note**

If the test timeout option is enabled and pin 21 remains high, the modem returns to online mode at the end of the test timeout period and will not re-enter the test mode until an off-to-on transition of pin 21 is detected.

DTE Controlled Local Analog Loopback (Pin 18) *LA

To enable DTE controlled local analog loopback test, enter **LA1*.

Enabled, the modem goes into local analog loopback when it detects an off-to-on transition of pin 18. Test ends when it detects an on-to-off transition of pin 18. To disable, enter **LA*.

| Command | Operation |
|---------|----------------------|
| *LA | Ignore pin 18 * |
| *LA1 | LAL enabled (pin 18) |

* default

**Note**

If the test timeout option is enabled and pin 18 remains high, the modem returns to idle mode at the end of the test timeout period and will not re-enter the test mode until an off-to-on transition of pin 18 has been detected.



Note

If the test timeout option is enabled and pin 18 remains high, the modem returns to idle mode at the end of the test timeout period and will not re-enter the test mode until an off-to-on transition of pin 18 has been detected.

Chapter 8 Security

GENERAL

The V.3400 series of modems provide three features to assure secure operation of the modem. These features are front panel password protection, autcallback, and secure mode of operation. The topic of front panel password protection is discussed in Chapter 4.

Two levels of major security operation are available: high and low. The AT commands for each level are explained below.

AUTOCALLBACK SECURITY

Autocallback is an additional security feature that is separate from Low and High Security. Autocallback forces an answering modem to dial the selected autodial (*AUn) telephone number after answering a call, holding the line for one second, and then disconnecting. When autocallback is enabled the modem will not train on a direct call. Access autocallback via Main Menu #5 on the LCD. Refer to Chapter 4 for further information. S72 enables/disables autocallback. S78 determines the delay in seconds before autocallback is initiated.

LOW SECURITY OPERATION

Low security operation provides password protection against unauthorized dial-up access. High security is another feature which is discussed later in this chapter. The security feature can be enabled/disabled with AT commands when operating on a dial-up system.

Transmitted data and received data lines are suppressed to the host DTE during security validation; all other signals (CTS, DSR, RI, etc.) operate as selected. After the password has been validated, the modem operates normally.

Operating without Low Security

The modem is not factory set for security and operates like a standard V.34, except for additional AT command which allow access to security. With these commands a user can set passwords and turn security on. When security is enabled, a password must be used to change security options.

Operating with Low Security

A secure modem will not allow data transfer between its host and a remote host until a correct password is received from the calling party. If an incorrect password is received the secure modem disconnects. The front panel is not locked out because this type of security prevents unauthorized dial-up access.

Remote Operation

The originating modem must transmit the correct security code before the secure modem will allow data transfer. If accessing a secure remote modem, the local modem prompts the user with

PLEASE ENTER YOUR PASSWORD =>

To Respond to the password prompt

Enter AT\$ followed by the password.

After receiving the \$ the secure remote modem accepts the security code and waits for a carriage return. Entering more than ten characters is invalid and causes the secure modem to disconnect. Entering a valid password causes the calling party's DTE to display PASSWORD ACCEPTED.

Local Operation

When accessing the local modem, the password is not required except when the user wants to change a security option. To change a password or to turn security on or off, the user must enter a password when entering the appropriate AT commands. EIA-232 signals to the DTE are not affected by security in command mode.

Passwords

Two passwords of up to ten characters each can be stored in the modem's nonvolatile memory. AT commands change the passwords. Backspace and escape keys are not supported for password entry. The passwords can consist of any printable characters except a dollar sign, comma, or space. Passwords are case sensitive.

The passwords have the same priority level and are interchangeable with each other. This can be helpful in situations such as when the user forgets one of the passwords.

LCD Indication of Security

The front panel LCD indicates whether security is on or off. If disabled, the LCD appears as if the security does not exist. If enabled, Main Menu #1 consists of the following display:

SECURE 28800
XXXX

Restrictions in Security Operation

If the caller gives the wrong password, while security is enabled, the modem will disconnect.

LOW SECURITY COMMANDS

The following AT commands operate low security:

Set Password \$S=x

The \$S=x command sets an empty password location to x. This command only applies when no password or only one is stored in memory. It can not be used to change a password.

Changing a Password \$C=x, y

The \$C=x, y command changes either password where x represents the old password and y is new one.

Deleting a Password \$C=x, -

The \$C=x, - command deletes password x from memory. Security is automatically disabled if the last password is deleted.

Security Reset \$DR

This command resets security to its initial state (off with no passwords stored). The option is not available in remote configuration.

Disabling Security \$D=x

The \$D=x command disables security where x is either password.

Security Status \$D?, \$E?

The **\$D?** or **\$E?** commands display the current status of security (on or off).

Enabling Security \$E=x

The **\$E=x** command enables security where *x* is either password.

HIGH SECURITY**Compatibility**

The calling modem does not require any security capabilities to connect with a secured V.3400. Access to the V.3400 host is gained by following the appropriate logon procedure as described in following text. All security operations are controlled by the secured V.3400.

Capacity

The modem stores in nonvolatile memory the password, security level, callback phone number, and status information for 50 users.

Operating without High Security

The modem is factory set with security disabled. In this mode the local DTE is connected to the local modem as usual except that the command to enable or view the status of the security feature will be accepted and processed.

Operating with High Security

With high security enabled, each user must follow the appropriate logon procedure. The procedure for remote users is determined by their assigned security level. Upon termination of the connection, the secured modem waits for the next call and password sequence. A local user must logon to the secured V.3400 to use the unit.

If a power outage occurs the logged on user must logon again when the power is restored.

For optimum security operation a reliable connection should be used.

SECURITY LEVELS

The V.3400 provides three levels of security to prevent unauthorized access by a remote user.

Level 1: Password Only

This is the lowest level of dial-up security. The user is prompted for an ID and password; if invalid, the modem hangs up.

Level 2: Password with Callback

This security level also requires that the user call from a pre-set telephone number. After the user enters a correct ID and password, the modem looks up the telephone number and calls the user back at that number.

Level 3: Password with Callback and Password Re-Entry

This is the highest level of security and is similar to Password with Callback except that after the user answers the callback call, the modem prompts him again for the password.

SUPERUSER

The superuser has access to all user information for administrative purposes and can change user logon requirements and privileges.

Superuser status can be gained at the local modem or from a remote Motorola or UDS modem via remote configuration, if the "Remote Superuser" option is enabled.

The superuser must first logon as a regular user, then request the superuser privilege.

Incorrect attempts to gain superuser privilege are logged in the users status information field in nonvolatile memory. After seven invalid attempts, the user is suspended from access to the V.3400 until cleared by the superuser.

To reinstate a suspended user, logon as a different regular user, then request superuser privilege in order to clear the illegal attempts count.

If the local superuser disables security, the only security commands available are those used to enable security or to check security status.

Passwords

Passwords can be changed or deleted by the superuser. The regular user can change his password only if the "user changes" option has been enabled by the superuser. Refer to the Extended Features section for more details.

When calling from a remote location, the user is prompted for a password. Once the password is entered, the user is either allowed direct access or disconnected and called back depending on the assigned security level.

During password entry or logon, each password character is displayed as an "X" on the DTE screen. The backspace key can be used for editing. For remote logon, the Esc key can be pressed prior to the carriage return to clear the password entry.

Incorrect password attempts exceeding the threshold set in S77 for a specific user will cause the modem to disconnect. Each call exceeding the threshold increments the ILLEGAL ATTEMPTS counter by one. After seven calls the ILLEGAL ATTEMPTS counter will have reached maximum and the user will be suspended.

Default Passwords

The modem is shipped from the factory with a default password for the superuser and for one regular user. They are

- SUPERUSER System administrator
- USER 1 User number 1

Passwords for users 2 through 50 are left blank.

It is recommended that the superuser change the default SUPERUSER and USER 1 passwords as soon as possible.

HIGH SECURITY COMMANDS

These commands are only allowed for a local superuser.

Enabling High Security \$EH=pw

The \$EH=pw command enables high security, where pw is the superuser's password.

To initialize high security for the first time enter

AT\$EH=SUPERUSER

to enable security, then enter

AT\$I=USER1 <CR> followed by
AT\$S=SUPERUSER <CR>

to gain superuser status. Passwords, security levels, and callback numbers can now be entered or modified.

When superuser activities are completed, return to regular user status by entering AT\$\$\$. Once in regular user status AT\$\$\$ becomes the final local logoff command.

Disabling High Security \$D

Enter the \$D command to disable security. The modem will operate as a nonsecure unit except that it will respond to enable and check security status commands.

Setting Passwords \$Pn=pw\$pw

Select a password between 4 and 34 printable ASCII characters.

To store the password enter:

AT\$Pn=pw\$pw

Where *n* is the user number (0-50) and pw is the new password which is entered twice to ensure that it has been entered correctly.

The \$ character is used as the marker between the dual password entries and cannot be used as part of the password.

Passwords cannot be recalled from nonvolatile memory.

Note

Superuser password is critical because the security feature cannot be configured without it.

After logon as USER 1 and gaining superuser privileges, enter the `$Pn` command to modify passwords.

For the superuser enter:

`AT$P0=pw$pw`

For user 1 enter:

`AT$P1=pw$pw`

Record the passwords in your personal records.

**Caution**

Do not forget the superuser password. Systems administrator functions cannot be accessed without it and the modem must be returned to the factory for re-initialization.

Set Security Levels `$Ln=m`

The System Administrator (superuser) assigns each user with a security level by entering the `$Ln=m` command (where n is the user number and m is the security level).

Set User Callback Number `$Cn=m`

The callback number, used with level 2 or 3 security, is dialed by the modem after a user has successfully called in from a remote location and entered their password.

Level 1 security does not require a callback number; however, if the security level is changed to level 2 or 3 a callback number will be required.

The callback number should be programmed initially using the `$Cn=m` command. Where n is the user number and m is the callback number.

Extended Features `$W`**`$W1`**

A regular user can change his password and callback number if the local superuser has enabled the `$W1` option.

`$W2`

A remote regular user can gain superuser privilege once the local superuser has enabled the `$W2` command.

`$W0`

The extended feature options can be cleared by a local superuser by entering the `$W0` command.

Display Extended Feature Status `$W?`

Enter the `$W?` command to display the status of the user changes and remote superuser options.

Display / Reset Illegal Access Attempt Counters `$M`, `$Mn`, `$M*`

This command informs the superuser of any illegal attempts to gain superuser status and the users current status. The status will either be "normal," indicating the user is still able to logon to the secure V.3400, or "suspended," indicating that the user made more than seven illegal attempts to gain superuser status and has been automatically suspended.

When the superuser logs on, the secure V.3400 automatically displays any illegal attempts since the last superuser logon. If it is not reset, the illegal attempt count will remain and the superuser will not be reminded unless more illegal attempts occur. To manually request this same information enter

`AT$M`

The V.3400 responds by scrolling any illegal attempt information onto the screen as in the following example:

USER NUMBER: 01, ILLEGAL ATTEMPTS: 1,
STATUS: NORMAL

USER NUMBER: 14, ILLEGAL ATTEMPTS: 7,
STATUS: SUSPENDED

OK

Enter the $\$Mn$ command (where n equals user number) to reset a specific user's illegal attempt count.

Enter the $\$M^*$ command to reset all of the user's illegal attempt count.

Factory Reset $\$F=pw\pw

To reinitialize the security feature enter the $\$F=pw\pw command (where pw is the "current" superuser password). This command deletes all user information and reinstates factory default passwords. User information cannot be recalled.

Removing a User $\$Rn$

This superuser command removes a user from active status without deleting all of the users information. The user can be restored to active status by setting the password with the corresponding user number as previously mentioned. The command to remove a user is

$AT\$Rn$

where n is the user numbers 2-50.

The superuser or user with ID #1 cannot be deleted from the user list.

Security Status $\$E?$

System security status can be verified using the $\$E?$ command.

Display User Status $\$S?$

Enter the $\$S?$ command to indicate whether or not the current user has superuser status.

The V.3400 responds with one of the following responses:

SUPERUSER STATUS
NORMAL STATUS

Verify User Information $\$In, \IBn

Security level and callback number can be displayed using either the $\$In$ or $\$IBn$ command. To display the assigned security level and callback number for a single user enter

$AT\$In$ where n is the user number.

A regular user can only check his own information. A user with superuser privileges can check any user's information.

A user with superuser privileges can also display the assigned security level and callback number for each valid user within a block of ten consecutive user numbers by entering:

$AT\$IBn$ where n is the first user number.

Request Superuser Privilege $\$S=pw$

Once logged on as a user, superuser privilege can be requested by entering the $\$S=pw$ command, where pw is the superuser password.

When the correct password has been entered, the V.3400 responds with

SUPERUSER STATUS

OK

Local Logon Command $\$n=pw$

Enter the $\$n=pw$ command to logon locally to the secure V.3400. Where n is the user number and pw is the password.

Local Logoff Command $\$S$

To logoff after a local session enter

$AT\$S$

Remote Logon Procedure $\$n=pw$

The remote logon procedure is required to access a secure V.3400. When calling into the secure V.3400 from a remote location the user is prompted to enter a password. The password must be entered as

Chapter 9

Fax Operation

GENERAL

The V.3400 can send and receive fax documents at speeds up to 14400 bps when used with the appropriate software. As a fax modem, the modem conforms to EIA-578 which defines a standard interface between the DTE (a PC with fax software) and the DCE as a fax modem.

When used with a Class 1 fax software package, V.3400 is CCITT Group 3 compatible and can send and receive documents at 2400, 4800, 7200, 9600, 12000, or 14400 bps with any Group 3 fax machine or PC with a fax modem.

Service Class selection configures the modem for Class 0 data mode or Class 1 fax mode. The LCD display indicates when fax mode is enabled. The V.3400 default configuration is for data mode; Service Class is normally only changed by the software as necessary.

Previous chapters in this manual contain information about the modem that should be understood prior to fax operation. Those chapters should be read before this chapter.

Users should understand the fax software manual before attempting fax communications.

FAX OPERATION

The user's manual for the Class 1 fax software package should provide most information necessary to configure the software and send and receive faxes.

The information in Chapter 2 of this manual should be considered as well, and also the next section of this chapter provides important information for proper fax communications.

MODEM INITIALIZATION

For fax operation, most fax software packages are equipped with a fax initialization command string. Entering this command sets the active profile for fax operation. In some cases certain options should be modified for particular requirements. The fax software manual provides information about requirements.

FAX DEFAULTS

Factory defaults along with the initialization command support fax operation. Some initialization commands include the default command *&F* and will reissue it for each fax operation. Users must be aware that some fax software packages do not include the default command or only issue the default command when the fax software is first loaded. Subsequent fax operations may not reset the fax profile and if a fax required option has been changed by the user fax operation will not work.

An example of a fax initialization command is *AT&F V E S0=0*

This can be interpreted as:

| | |
|-----------------|--|
| <i>AT&F</i> | Reset the active profile to the factory default. |
| <i>V</i> | Set response messages to digit code. |
| <i>E</i> | Disable local echo (off). |
| <i>S0=0</i> | Disable autoanswer (off). |

Fax Autoanswer

Some fax software takes control of autoanswer, disables autoanswer for the modem, and answers the phone as internally programmed. Other programs do not control autoanswer at all and require the modem to have autoanswer enabled. The user must check the software manual for the particular requirements and refer to Chapter 4 for manual/autoanswer and TALK/DATA selection. Select the necessary options for fax operation.

FAX ASSOCIATED OPTIONS

A number of options can be changed without any effect on fax operation. These include items like speaker volume and pause for carrier. Appendix E lists the AT commands and indicates how they may affect fax operation. These commands can be incorporated by personal preference into the initialization command. The user should compare fax operation requirements with Appendix A and if necessary generate an initialization command string compatible with the software and the modem.

Stored FAX Profile

Another alternative is to develop a fax initialization command and store it in one of the user defined profiles. Fax initialization would include the command that recalls that profile for fax operation. The user must keep track of option changes between fax transmissions and if required reset the fax profile for the next fax transmission.

CLASS 1 DETAILS

Operation as a fax modem complies with EIA-578; details of Class 1 operation and compatibility are found in that standard. There is no need to be familiar with these details since they are handled by the Class 1 software package, but this section briefly summarizes some of them.

As a Service Class 1 facsimile DCE, the V.3400 provides the basic services required to support Group 3 facsimile operation. Support from a Class 1 facsimile DTE is required to implement the CCITT T.30 recommendations for fax document transmission and the CCITT T.4 recommendations for encoding fax images. Using software control the modem can

- connect calls
- generate messages
- detect waiting and silence
- transmit and receive data
- provide HDLC data framing, transparency, and error detection

The modem also filters data streams to and from the DTE in accordance with the Class 1 specification.

The Class 1 standard assumes a serial asynchronous DTE-DCE connection using EIA-232D (or CCITT V.24) circuits. EIA-232D circuits AB (signal ground), BA (transmitted data), and BB (received data) are required for fax operation, while additional circuits are optional. Refer to Chapter 2 for hardware installation and EIA-232D data interface information.

The modem uses inband unidirectional DC1/DC3 (XON/XOFF) flow control to match the DTE-DCE data rate to the line signaling rate (hardware RTS/CTS is optional). Since 1200 bps is the minimum rate needed to support T.30 Phase C data transfer using V.29 9600 bps, a serial port data rate of at least 19200 bps should be used with the modem. Since flow control is used, this rate should not be changed during fax operation. The modem detects the DTE-DCE data rate from the AT command prefix as described in Chapter 5.

CLASS 1 COMMANDS

The commands in this section are normally issued by the fax software and not by the user. They are provided here for reference. While only the lower order 7 bits of each character are used for commands and parameters, Phase C data transmission or reception requires all 8 data bits. Therefore, a data format which uses 8 data bits should be used for fax mode.

Dial Command D

The dial command *D*, described in Chapter 5, tells the modem to go off hook, dial, and begin call origination. For fax operation, set the modem for Service Class 1 operation before the dial command is issued; use the +FCLASS=1 command.

The dial modifier, except *R*, can also be used in fax mode. Depending on the *X* option selected, the modem will return the BUSY and NO DIALTONE result codes as appropriate. If the modem is in the online command state when a dial command is issued (e.g., a connection has already been established), the modem returns an ERROR result code. The NO CARRIER result code indicates that a connection could not be established (no carrier detected) within the number of seconds specified in status register *S7*, or the dial command has been aborted due to a character sent from the DTE.

After dialing the specified number in fax mode, the modem generates 1100 Hz CNG tones in accordance with T.30 while trying to detect either CED (answer back tone) or the HDLC preamble of the first T.30 frame. The CNG tones cease after detecting either of these two signals. To allow proper interaction with manually answered fax stations, detection of CED is not required. After detecting 1650 Hz (i.e., the HDLC preamble of the first frame), the modem enters V.21 Channel 2 receive state with HDLC framing and returns a CONNECT result code. This is because dialing in fax mode (*+FCLASS=1*) implies an initial *+FRH=3* command described later in this section.

Answer Command A

The *A* command instructs the modem to answer the call. For fax operation, set the modem for Service Class 1 operation before the *A* command is issued; use the *+FCLASS=1* command.

If the modem is in the online command state when an answer command is issued (e.g., a connection is already established), modem returns an ERROR result code. Otherwise, it answers the call and generates a 2100 Hz CED (answer back) tone in accordance with T.30. The modem then enters V.21 Channel 2 transmit state with HDLC framing and returns a CONNECT result code. This is because answering a call in fax mode (*+FCLASS=1*) implies an initial *+FTH=3* command described later in this section. In accordance with T.30, to allow proper interaction with a manually originated fax call, the modem does not require detection of CNG before generating CED or entering HDLC transmit mode.

If the DTE sends a character while executing the answer command and before CED is completed, the call is released and the modem will send the NO CARRIER result code.

On Hook H

In fax mode, the *H* command instructs the modem to stop any transmission and terminate the call by going on hook.

Off Hook H1

The *H1* command instructs the modem to go off hook. In fax mode, this might be used when the user has used manual dialing to place a fax call. In this case, no CNG tones are generated and the initial *+FRH=3* is not implied; it must be explicitly issued by the software.

Class 0 Operation +FCLASS=0

Setting the Service Class to 0 with the *+FCLASS=0* command sets the modem in data mode. This default setting is normally only changed by software if needed.

Class 1 Operation +FCLASS=1

Setting the Service Class to 1 with the *+FCLASS=1* command configures the modem as a Class 1 fax modem. This command is normally only issued by the fax software if needed. When set, the LCD displays FAX CLASS 1 MODE.

Service Class Indication +FCLASS?

The current Service Class setting can be determined with the *+FCLASS?* command. A 0 response indicates the modem is configured for data mode while a 1 indicates it is set for fax mode. This information text is preceded and followed by <CR><LF> in addition to being followed by an appropriate result code response.

Service Class Capabilities +FCLASS=?

The available Service Classes can be revealed by the *+FCLASS=?* command. The modem responds with the information text 0, 1 (preceded and followed by <CR> <LF>), indicating that the modem supports both data communication and Class 1 fax operation.

Transmit Silence +FTS=(Time)

The command *+FTS=(Time)* causes the modem to wait in silence for the specified amount of time and then send the OK result code to the DTE. The *(Time)* value is in 10 ms increments from 0 to 2.55 seconds. The modem aborts the command and sends an OK result code if the DTE sends an additional character, which is discarded, during the command execution. This command returns an ERROR result code if issued while the modem is on hook.

Receive Silence +FRS=(Time)

The command +FRS= causes the modem to listen for silence and report back an OK result code when the line has been silent for the specified amount of time. The (Time) value is in 10 ms increments from 0 to 2.55 seconds.

The modem aborts the command and sends an OK result code if the DTE sends an additional character, which is discarded, during the command execution. This command returns an ERROR result code if issued while the modem is on hook.

Fax Transmit and Receive Modes

The following commands instruct the modem to transmit or receive facsimile data with the designated modulation. Flow control, data buffering, and data filtering are used as appropriate, in accordance with the Class 1 specification. Each of these commands must be the last command on the command line.

| Command | Description |
|------------|---------------------------------------|
| +FTM=(MOD) | Transmit data with (MOD) carrier |
| +FRM=(MOD) | Receive data with (MOD) carrier |
| +FTH=(MOD) | Transmit HDLC data with (MOD) carrier |
| +FRH=(MOD) | Receive HDLC data with (MOD) carrier |

The modem accepts one of the values listed in Table 9-1.

Table 9-1. Modulation Values

| Value | Modulation | Speed |
|-------|----------------|------------|
| 3 | V.21 channel 2 | 300 bps |
| 24 | V.27 ter | 2400 bps |
| 48 | V.27 ter | 4800 bps |
| 72 | V.29 | 7200 bps |
| 73 | V.17 | 7200 bps |
| 74 | V.17 | 7200 bps * |
| 96 | V.29 | 9600 bps |
| 97 | V.17 | 9600 bps |

Table 9-1. Modulation Values (Continued)

| Value | Modulation | Speed |
|-------|------------|-------------|
| 98 | V.17 | 9600 bps * |
| 121 | V.17 | 12000 bps |
| 122 | V.17 | 12000 bps * |
| 145 | V.17 | 14400 bps |
| 146 | V.17 | 14400 bps* |

* with short train

The V.3400 returns an ERROR result code if any of the above commands are issued while the modem is on hook.

Facsimile Transmit +FTM=(Mod)

+FTM= (Mod) causes the modem to transmit data using the modulation and speed selected with the (Mod) parameter. For V.27 ter, V.29, and V.17 modulations, the modem first transmits the required training sequence (with echo protector tone). After it is appropriately configured for transmission, the modem returns the CONNECT result code and transmits constant 1 bits until data is received from the DTE. For additional information, consult the Class 1 specification.

Facsimile Receive +FRM=(Mod)

+FRM= (Mod) causes the modem to receive data using the modulation and speed selected with the (Mod) parameter. If the selected carrier is detected, a CONNECT result code is sent to the DTE; if a different signal is detected, the modem sends a +FCERROR (CONNECT ERROR) result code and returns to command mode. This command is aborted if the DTE sends any character to the modem other than DC1 or DC3 during this mode. For additional information, consult the Class 1 specification.

HDLC Transmit +FTH=(Mod)

+FTH=(Mod) causes the modem to transmit HDLC framed data using the modulation and speed selected with the (Mod) parameter. For V.27 ter, V.29, and V.17 modulations, the modem will first transmit the required training sequence (with echo protector tone). Configured for HDLC transmission, the modem transmits HDLC flags and returns the

CONNECT result code. HDLC flags will continue to be sent until the first byte of data is received from the DTE or until 5 seconds elapses with no data. For additional information, refer the Class 1 specification.

HDLC Receive +FRH=(Mod)

The command *+FRH=(Mod)* causes the modem to receive HDLC framed data using the modulation and speed selected with the *(Mod)* parameter. If the selected carrier is detected, a CONNECT result code is sent to the DTE; if a different signal is detected, the modem sends a +FCERROR (CONNECT ERROR) result code and returns to command mode. This command will be aborted if the DTE sends any character to the modem other than DC1 or DC3 during this mode. For additional information, consult the Class 1 specification.

Test Supported Range of Values +FTx=?, +FRx=?

The supported range of values for any of the fax transmit or receive commands can be determined with the *+FTx=?* or *+FRx=?* command where *x* is *M*, *H*, or *S*. The normal transmit and receive capabilities are interrogated with *+FTM=?* and *+FRM=?*, while the HDLC transmit and receive capabilities are interrogated with *+FTH=?* and *+FRH=?*. Since the modem can send and receive normal data or HDLC data at all valid speeds up to 14400 bps, the modem returns the information text 3, 24, 48, 72, 73, 74, 96, 97, 98, 121, 122, 145, 146 for any of these four commands if *x* is *M* or *H*. For the commands *+FTS=?* or *+FRS=?* the modem returns the information text 0-255, indicating an allowed time interval from 0 to 2.55 seconds. The appropriate information text is always preceded and followed by <CR><LF> and followed by an appropriate result code response.

Class 1 Result Code +FCERROR

If the modem detects any carrier or tone that differs from that specified in a *+FRM* or *+FRH* command, it sends the +FCERROR result code and returns to command state, allowing the DTE to attempt a recovery. The numeric form of this response is +F4.

Fax Auto Answer +FAA=

The modem can be set up to automatically detect if a fax or data call is being answered. The command `+FAA=1` enables this function and `+FAA=0` disables it. This feature requires special support by the fax software package.

| Command | Description |
|---------|-------------------------|
| +FAA=0 | Disable fax auto answer |
| +FAA=1 | Enable fax auto answer |

BINARY FILE TRANSFER

Some Class 1 software packages may provide an option for transferring files between computers with fax modems, using a Binary File Transfer (BFT) standard. Although the received file is not a fax image, transmitting the file is similar to sending a fax. Since the modem allows T.30 error correction mode (with HDLC framing up to 9600 bps), fax mode can also be used for BFT if supported by the Class 1 software package. The Binary File Transfer is an option in the fax software package, not a separate mode of operation.

Chapter 10

Status Registers

S-REGISTERS

Most modem configuration information is stored in a part of memory called status (S) registers. During operation this information is used to determine modem functions.

The information stored in the S-registers can be changed by the AT or V.25 command sets and by pushbuttons in response to the LCD prompt. These are the preferred methods. Some software programs also access the S-registers via the AT command set, but this action is transparent to the user. The command indicates which memory bit(s) to alter to select a particular option or to perform a certain function. The S-register values comprise the configuration profile.



Caution

The purpose of this tutorial is to show the versatility of option selection and register function. It is strongly recommended that the preferred methods of option selection be used. This tutorial uses S22 as the example register. Certain modems may use S22 differently or may not have an S22.

Generally the user should not directly alter S-register values. However, the user has the option of entering S-registers via ATS commands and directly altering the register value. This is called "writing" to the S-register. Writing to an S-register is not a preferred method and should only be used by programmers who need to manipulate S-registers so they can interact with a software program under development or some other similar action.

Certain S-registers cannot be altered by the ATS command series. These are called "read only" S-registers. Appendix E contains a listing of S-registers and indicates if they are read only or read and write.

Figure 10-1 illustrates how the different inputs to an S-register (S22 in this case) are used to select a particular option. Bits 3 and 2 of S22 control speaker options. Some communication software packages may use the AT command set. For example purposes bit values are arbitrary.

Bit values for S-registers must not be confused with the total register value. Bit values are counted separately for each option group, called bit mapping, while the register value is the cumulative decimal or hexadecimal total. The decimal value counts all eight bits as a single group. Hexadecimal values split the bits into two groups of four each. Writing to an S-register changes the total value. Figure 10-2 illustrates the difference between decimal calculation and hexadecimal calculation.

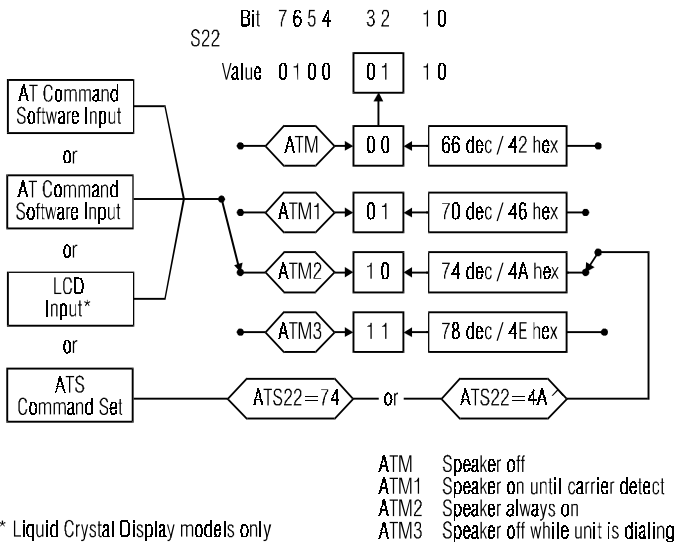


Figure 10-1 Changing S-Register Values

| | | | | | | | | |
|-------------------|-----|----|----|----|-----|---|---|------------|
| Bit | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Decimal Value | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
| S22 Value | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 |
| Decimal Total | 64 | | | | + | 4 | + | 2 = 70 dec |
| Hexidecimal Value | 8 | 4 | 2 | 1 | 8 | 4 | 2 | 1 |
| S22 Value | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 |
| Hexidecimal Total | 4 | | | | and | 4 | + | 2 = 46 hex |

Figure 10-2 Calculating S-Register Values

S-REGISTER OPERATION $Sn?$, $Sn^{?^{\wedge}}$

Enter $ATS_n?$ to read a register value, where n =register number for a decimal value; or $ATS_n^{?^{\wedge}}$ for a hexadecimal value.

For example, to determine the current backspace character enter

$ATS_5?$

The screen will show the ASCII value of the backspace character stored in register S_5 .

Changing Register Values $Sn=v$, $Sn^{=^{\wedge}v}$

To change an option using ATS commands requires the operator to precalculate the revised decimal (or hexadecimal) total. Because of the chance of miscalculating the bit sum, causing unplanned option changes, writing to an S-register is discouraged. For operators who prefer this method of option selection a much simplified command that eliminates the decimal calculation is explained in the *Individual Bit Command* section.

Enter $ATSn=v$ to change a register value, where n = register number and v = decimal value; or $ATSn=\text{^}v$, where $\text{^}v$ = hexadecimal value.



Note

*Not all registers can be set by the $ATSn=v$ (or $\text{^}v$) command.
Some registers are for reference only.*

To change the escape character from + to the Esc key (ASCII value of 27)

Enter $ATS2=27$

To return the modem to the command mode press the Esc key three times:

(pause) Esc Esc Esc (pause)

Individual Bit Command $S n . \# = v$

Some operators use AT commands as the primary method of changing S-register options. However, some options stored in registers do not have an associated AT command. For these options, the individual bit AT command can be used to change the setting of the bit controlling the option.

To change a single bit value within a register

Enter $ATSn . \# = v$

where n = register number $\#$ = bit position 0 through 7 v = bit value 1 or 0

Example:

S-register 27, bit 2 selects between dial-up or leased line operation.

AT command method:

$AT\&L$ selects dial-up operation (sets S27 bit 2 to 0)

AT&L1 selects leased line operation (sets S27 bit 2 to 1)

Individual bit method:

ATS27.2=0 selects dial-up operation (sets S27 bit 2 to 0)

ATS27.2=1 selects leased line operation (sets S27 bit 2 to 1)

**Note**

This way of selecting options can be used on all S-registers except read only registers.

Autoanswer S0

This register turns the option on or off. Set the register to 0 to turn autoanswer off.

Set the register to any value other than zero (1-255) to turn autoanswer on. The number selected is the ring count the modem answers on. For example, if *S0* equals 4, the modem answers the call on the fourth ring. The default value is 1.

Ring Count S1

This register contains the ring count for a current incoming call and should not be changed. If developing communications software, the program can read the register to determine the ring total.

Escape Character S2

The standard escape character is a + sign (ASCII value of 43). To change the character, set *S2* to the desired ASCII value (0-255).

To disable the escape command, set *S2* to any value greater than 127.

End-of-Line Character S3

The standard end of line character is the carriage return (ASCII value of 13). This character ends each command as it is sent to the modem. It is also sent by the modem after each status message or number code.

To change the character, set *S3* to the desired ASCII value (0-127).

Line Feed Character S4

The standard character is the line feed (ASCII value of 10). This character is sent by the modem after each status message. To change it, set *S4* as desired (0-127).

Backspace Character S5

The standard character is the backspace (ASCII value of 8). To change it, set *S5* to the desired value (0-127).

Pause Before Dialing S6

When dial tone detection is disabled (command *X*, *X1*, or *X3* in effect), the modem waits the number of seconds (0-255) stored in this register before dialing. The default value is 2 (seconds).

Pause for Ringback and Carrier Detection / Wait for 2nd Dial Tone S7

If no ringback is detected in the number of seconds in *S7* (1-255), the modem disconnects and sends the NO CARRIER message or code. If ringback is detected, the modem begins to look for a carrier.

If no carrier is detected within the number of seconds in *S7*, the modem hangs up and sends the NO CARRIER message or code.

Values between 1 and 255 may be used. The default value is 30 (seconds).

Pause Interval for Comma S8

When a dial command contains a comma, the modem pauses the number of seconds in *S8*.

Change *S8* to change the basic pause interval (0-255), or use several commas in a row for greater delay during dialing.

The default value is 2 (seconds).

Carrier Detect Time S9

S9 contains the amount of time (0-255) in 0.1 second increments the carrier must be present to be recognized. The default value is 6 (0.6 second). This timer can be extended to lessen the likelihood of false detection of carrier.

Lost Carrier Detect Time S10

S10 contains the amount of time (0-255) in 0.1 second increments carrier must be absent to be recognized as a loss of carrier. The default value is 14 (1.4 seconds).

DTMF Tone Duration S11

S11 determines the length of DTMF tones. The period of silence is equal to the duration of the tone. The value of this register must be entered in multiples of 10. Default value is 80 (80 ms).

Escape Sequence Pause S12

Using the escape sequence to return to command mode from data mode requires two pauses, one before and one after the escape characters.

The pauses prevent the modem from responding to a character sequence which might contain the escape sequence as part of its normal data transmission.

S12 contains the pause interval in 0.02 second increments. The factory setting is 50, equivalent to 1 second (50 x 0.02 sec). When *S12* is 0 then timing is not a factor.

The timing between the 3 escape characters must be less than the pause interval or the escape sequence will not be detected. The data rate also affects the timing and must be taken into account when changing the pause interval.

To disable the escape command, set *S2* to a value greater than 127 instead of changing *S12*. Values between 15 and 255 may be used for *S12*.

**Note**

When S-registers have parallel AT commands, the commands are listed in the register tables as a cross reference. If no command exists for the option the column is left blank.

S13

Not used

Bit Mapped S14

| Bit | Value | Command | Description |
|-----|--------|-------------|--|
| 0 | --- | --- | Reserved |
| 1 | 0 1 | E E1 | Local character echo off Local character echo on * |
| 2 | 0 1 | Q Q1 | Response messages on * Response messages off |
| 3 | 0 1 | V V1 | Response messages as digit codes Response messages as words * |
| 4 | 0 1 | Q2 | Ignore * Response messages in originate mode only |
| 5 | 0 1 | T P | Tone dial * Pulse dial |
| 6 | 0 1 | H2 -- | Normal hang up * Not used |
| 7 | 0 1 | *OR1 *OR | Forced answer Normal originate * |

* default



Note

Registers that contain more than one option are called "bit mapped" registers.

S15

Reserved

System Tests S16

This register contains the status of system test options.

| Bit | Value | Command | Description |
|-----|-------|---------|--|
| 0 | 0 | | Analog loopback inactive |
| | 1 | | Analog loopback in progress |
| 1 | | | Reserved |
| 2 | 0 | | Digital loopback inactive |
| | 1 | | Digital loopback in progress |
| 3 | 0 | | Remote digital loopback requested by other modem inactive |
| | 1 | | Remote digital loopback requested by other modem in progress |
| 4 | 0 | | Remote digital loopback inactive |
| | 1 | | Remote digital loopback in progress |
| 5 | 0 | | Self test remote digital loopback inactive |
| | 1 | | Self test remote digital loopback in progress |
| 6 | 0 | | Self test analog loopback inactive |
| | 1 | | Self test analog loopback in progress |
| 7 | | | Reserved |

S17

Not used

Test Timeout S18

The amount of time, in 1 second increments, that a diagnostic test will run is determined by the value assigned to *S18* (0-255). A value of 0 disables the timer allowing a test to run indefinitely. The default value is 0.

S19, 20

Not used

Bit Mapped S21

| Bit | Value | Command | Description |
|------|-------|---------|---|
| 6, 0 | 00 | &S | DSR forced on * |
| | 10 | &S1 | DSR on when online |
| | 01 | &S2 | DSR off 5 seconds after disconnect |
| | 11 | &S3 | DSR follows off hook (OH) |
| 5, 1 | 00 | &C | DCD always on * |
| | 10 | &C1 | DCD on while carrier present |
| | 01 | &C2 | DCD on except for 5 seconds after disconnect |
| | 11 | &C3 | DCD follows RTS on remote modem; not valid in reliable mode |
| 2 | 0 | &R | CTS follows RTS by S26 delay |
| | 1 | &R1 | CTS always on * |
| 4, 3 | 00 | &D | Modem ignores DTR * |
| | 01 | &D1 | Modem assumes command mode when DTR turns off |
| | 10 | &D2 | Modem hangs up when DTR turns off |
| | 11 | &D3 | Modem resets when DTR turns off |
| 7 | 0 | Y | Long space disconnect disabled |
| | 1 | Y1 | Long space disconnect enabled * |

* default

Bit Mapped S22

| Bit | Value | Command | Description |
|------|-------|---------|--|
| 1, 0 | 00 | L | Speaker volume low |
| | 01 | L1 | Speaker volume low |
| | 10 | L2 | Speaker volume medium * |
| | 11 | L3 | Speaker volume high |
| 3, 2 | 00 | M | Speaker off |
| | 01 | M1 | Speaker on until carrier detect * |
| | 10 | M2 | Speaker always on |
| | 11 | M3 | Speaker off when modem is dialing |
| 6-4 | 000 | X | CONNECT message only, blind dials, no busy detect |
| | 001 | X1 | CONNECT / appropriate code for rate, blind dials, no busy detect |
| | 010 | X2 | CONNECT / appropriate code for rate, waits for dial tone, no busy detect |
| | 011 | X3 | CONNECT / appropriate code for rate, blind dials, reports BUSY |
| | 100 | X4 | CONNECT / appropriate code for rate, waits for dial tone, reports BUSY * |
| 7 | 0 | &P | Make / break ratio (US) 39/61 * |
| | 1 | &P1 | Make / break ratio (UK) 33/67 |

* default

Bit Mapped S23

| Bit | Value | Command | Description |
|------|-------|---------|---------------------------------------|
| 0 | 0 | &T5 | Remote digital loop request denied |
| | 1 | &T4 | Remote digital loop request granted * |
| 5-1 | --- | --- | Reserved |
| 7, 6 | 00 | &G | No guard tones * |
| | 01 | &G1 | 550 Hz guard tone |
| | 10 | &G2 | 1800 Hz guard tone |
| | 11 | -- | Not used |

* default

S24

Not used

DTR State Recognition S25

The S25 register specifies the amount of time (0-255) in 0.01 second (10 ms) increments that DTR must stay high or low in order to be recognized as such. The default value is 5 (0.05 second).

RTS/CTS Delay S26

The S26 register specifies the amount of time (0-255) in 0.01 second (10 ms) increments between the RTS signal and the CTS signal. The default value is 0.

Bit Mapped S27

| Bit | Value | Command | Description |
|------|-------|----------------|------------------------------|
| 1, 0 | 00 | &M | Async * |
| | 01 | &M1 | Sync data / async dial |
| | 10 | &M2 | Sync data / dial through DTR |
| | 11 | &M3 | Sync data / manual dial |
| 2 | 0 | &L | Dial-up line * |
| | 1 | &L1 and &L2 | Leased line |
| 3 | -- | -- | Reserved |
| 5, 4 | 00 | &X | Internal clock * |
| | 01 | &X1 | External clock |
| | 10 | &X2 | Receive clock |
| | 11 | -- | Not used |
| 6 | 1 | | Enable async DTR dialer |
| | 0 | | Disable async DTR dialer * |
| 7 | -- | -- | Reserved |

* default

Lookback Timer S28

The S28 register specifies the amount of time in 1.0 minute increments that the modem will remain in dial backup mode before retrying leased line mode. A zero will disable automatic lookback to leased line. The default value is 15 minutes.

| Bit | Value | Command | Description |
|------|-------|---------|--|
| 7- 0 | 0-255 | | Time in 1 minute increments (0=disabled) |

Bit Mapped S29

| Bit | Value | Command | Description |
|------|-------|---------|----------------------------------|
| 0 | 0 | *NT1 | Enable AT command set * |
| | 1 | *NT | Disable AT command set |
| 1 | 0 | *RO | Options retained at disconnect * |
| | 1 | *RO1 | Options restored at disconnect |
| 2 | 0 | *FT | Disable V.32 fast train * |
| | 1 | *FT1 | Enable V.32 fast train |
| 6, 3 | -- | -- | Reserved |
| 7 | 0 | *FB | DTE fallback disabled * |
| | 1 | *FB1 | DTE fallback enabled |

* default

Bit Mapped S30

| Bit | Value | Command | Description |
|------|-------|---------|---------------------|
| 0 | -- | -- | Reserved |
| 1 | 0 | | V.25 ASCII * |
| | 1 | | V.25 EBCDIC |
| 2 | 0 | | V.25 VAL enabled * |
| | 1 | | V.25 VAL disabled |
| 4, 3 | -- | -- | Reserved |
| 5 | 0 | | NRZ V.25 * |
| | 1 | | NRZI V.25 |
| 7, 6 | 00 | &M | V.25 disabled * |
| | 01 | &M4 | V.25 bisync enabled |
| | 10 | &M5 | V.25 SDLC enabled |
| | 11 | &M6 | V.25 Async enabled |

* default

S31

Reserved

Bit Mapped S32

| Bit | Value | Command | Description |
|-----|--------|-------------------------------|---|
| 0 | 0 1 | &L1 &L2 | 2-wire (leased line only) * 4-wire (leased line only) |
| 1 | 0 1 | *LC1 *LC2 | Line current disconnect = short Line current disconnect = long * |
| 2 | 0 1 | *LC *LC1 <i>or</i> *LC2 | Line current disconnect = disable Line current disconnect = enable * |
| 3 | 0 1 | *DB *DB1 | Dial backup = manual * Dial backup = automatic |
| 7-4 | -- | -- | Reserved |

* default

S33

Reserved

Bit Mapped S34

| Bit | Value | Command | Description |
|-----|--------|-------------|---|
| 0 | 0 1 | *AN *AN1 | Bilateral analog = disable * Bilateral analog = enable |
| 1 | 0 1 | *DG *DG1 | Bilateral digital = disable * Bilateral digital = enable |
| 2 | 0 1 | *LA *LA1 | DTE commanded LAL = disable * DTE commanded LAL = enable |
| 3 | 0 1 | *RD *RD1 | DTE commanded RDL = disable * DTE commanded RDL = enable |
| 7-4 | -- | -- | Reserved |

* default

DTR / Dial Backup Number to Dial S35

Select the number to automatically dial (1-9 of stored numbers) for the modem to dial in DTR dialing or autodial backup.

S36-S38

Reserved

Bit Mapped S39

| Bit | Value | Command | Description |
|-----|--------|------------|---|
| 0-4 | | | Reserved |
| 5 | 0 1 | DCE DCE | Connect MSG disabled * Connect MSG enabled |
| 6-7 | | | Reserved |

* default

S40-S43

Reserved

XON Character from DTE S44

Select the XON character (0-127) to be sent from the DTE. The default value is 17.

XOFF Character from DTE S45

Select the XOFF character (0-127) to be sent from the DTE. The default value is 19.

S46-48

Reserved

XON Character to DTE S49

Select the XON character (0-127) to be sent to the DTE. The default value is 17.

XOFF Character to DTE S50

Select the XOFF character (0-127) to be sent to the DTE. The default value is 19.

S51

Reserved

Bit Mapped S52

The S52 register selects leased line transmit level from 0 to -30 dBm in 1 dB increments.

| Bit | Value | Command | Description |
|-----|---------|---------------|--|
| 4-0 | 0 to 30 | *TLn (n=0-30) | Transmit level in dB (0 through -30 dBm) * |
| 7-5 | -- | -- | Reserved |

* default

Automatic Rate Adaption Threshold S53

| Bit | Value | Command | Description |
|------|----------------------|-------------------------|---|
| 1, 0 | -- | -- | Reserved |
| 3, 2 | 00 01 10 11 | %R %R1 %R2 %R3 | Automatic rate adaption threshold disabled * Low BER Medium BER High BER |
| 4 | -- | -- | Reserved |
| 5 | 0 1 | | Protocol Neg status disabled * Protocol Neg status enabled |
| 6-7 | -- | -- | Reserved |

* default

Flow Control S54

The S54 register selects the flow control options.

| Bit | Value | Command | Description |
|------|-------|---------|---|
| 1, 0 | 00 | \Q | Disable DTE flow control |
| | 01 | \Q1 | Enable DTE XON/XOFF flow control * |
| | 10 | \Q2 | Enable CTS flow control to the DTE |
| | 11 | \Q3 | Enable bilateral CTS/RTS flow control |
| 2 | -- | -- | Reserved |
| 3 | 0 | \G | Disable modem port flow control * |
| | 1 | \G1 | Enable modem port XON/XOFF flow control |
| 4 | 0 | \X | No XON/XOFF characters to remote * |
| | 1 | \X1 | Pass XON/XOFF characters to remote |
| 6, 5 | 00 | \Q4 | Disable flow control from DCE |
| | 01 | \Q5 | Enable XON/XOFF flow control * |
| | 10 | \Q6 | Enable CTS flow control to the DTE |
| | 11 | \Q7 | Enable CTS flow control to the DTE |
| 7 | -- | -- | Reserved |

* default

S55

Reserved

V.42 Compression Control S56

| Bit | Value | Command | Description |
|------|-------|---------|--|
| 1, 0 | 00 | %C | Compression disabled |
| | 01 | %C2 | Compression enabled on transmit data only |
| | 10 | %C3 | Compression enabled on receive data only |
| | 11 | %C1 | Compression enabled on transmit and receive data * |
| 7-2 | -- | -- | Reserved |

* default

Bit Mapped S57

| Bit | Value | Command | Description |
|------|-------|---------|--|
| 0 | 0 | *RC | Standard number codes * |
| | 1 | *RC1 | 15 - 4800 bps 18 - 9600 bps Alternate number codes 11 - 4800 bps 12 - 9600 bps |
| 4-1 | -- | -- | Reserved |
| 5 | 0 | | Busy out disabled * |
| | 1 | | Busy out enabled during LAL test mode (for private PBX use only) |
| 7, 6 | -- | -- | Reserved |

* default

Inactivity Timer S58

The S58 register specifies the number of minutes the modem waits before terminating a call when no data is sent or received. This register is active when in error control mode. 0 disables timer. Issue the \Tn command to load inactivity timer, n=0-255 minutes.

| Bit | Value | Command | Description |
|-----|-------|--------------|------------------------|
| 7-0 | 0 | \T | Disable * |
| | 1-255 | \T (n=1-255) | Timer value in minutes |

* default

Break Control S59

The S59 register determines the action taken when a break is encountered. Refer to Break Control section in Chapter 6 for further explanation.

| Bit | Value | Command | Description |
|-----|-------|---------|------------------|
| 2-0 | 000 | \K | Break option 0 |
| | 001 | \K1 | Break option 1 |
| | 010 | \K2 | Break option 2 |
| | 011 | \K3 | Break option 3 |
| | 100 | \K4 | Break option 4 |
| | 101 | \K5 | Break option 5 * |
| 7-3 | -- | -- | Reserved |

* default

Bit Mapped S60

| Bit | Value | Command | Description |
|------|-------|---------|--|
| 0 | 0 | %E | Disable auto retrain |
| | 1 | %E1 | Enable auto retrain * |
| 1 | 0 | | MNP compression disabled |
| | 1 | | MNP compression enabled * |
| 2 | 0 | \C | Disable auto-reliable data buffer * |
| | 1 | \C1 | Buffer data for 4 seconds or 200 characters |
| 5- 3 | -- | -- | Reserved |
| 6 | 0 | \R | RI blinks for ring and remains on for duration of call |
| | 1 | \R1 | RI blinks for ring and turns off when call is answered * |
| 7 | 0 | \V | Disable protocol response messages * |
| | 1 | \V1 | Enable protocol response messages |

* default

DTE Options S61

The *S61* register indicates the character size and parity. This register is for reference only.

| Bit | Value | Command | Description |
|------|-------|---------|-------------------|
| 2-0 | -- | -- | Reserved |
| 3 | 0 | | 7 bit word length |
| | 1 | | 8 bit word length |
| 5, 4 | 00 | | Mark parity |
| | 01 | | No parity |
| | 10 | | Odd parity |
| | 11 | | Even parity |
| 7, 6 | -- | -- | Reserved |

* default

Disconnect Buffer Delay S62

The *S62* register determines the delay before disconnect, to allow buffers to empty, when disconnect conditions exist.

| Bit | Value | Command | Description |
|-----|-------|---------|---|
| 7-0 | 0 | %D | Buffer disabled * |
| | 1-255 | %Dn | Disconnect buffer delay value (seconds) |

* default

Maximum Transmit Block Size S63

The *S63* register sets the maximum transmit block size.

| Bit | Value | Command | Description |
|-----|-------|---------|----------------------------|
| 7-0 | 63 | \A | Maximum block size = 64 |
| | 127 | \A1 | Maximum block size = 128 |
| | 191 | \A2 | Maximum block size = 192 |
| | 255 | \A3 | Maximum block size = 256 * |

* default

Auto-Reliable Fallback Character S64

The *S64* register stores the selected ASCII value of the auto-reliable fallback character.

| Bit | Value | Command | Description |
|-----|-------|---------|--|
| 7-0 | 0 | %A | Disable auto-reliable fallback character * |
| | 1-127 | %An | ASCII value 1-127 |

* default

S65-66

Reserved

Link Speed Status S67

The S67 register indicates the true data link (DCE) speed. This register is for reference only.

| Bit | Value | Command | Description |
|-----|-------|---------|------------------|
| 4-0 | 00000 | | N/A |
| | 00001 | | 300 bps |
| | 00010 | | Reserved |
| | 00011 | | 1200 bps |
| | 00100 | | 2400 bps |
| | 00101 | | 4800 bps |
| | 00110 | | 7200 bps |
| | 00111 | | 9600 bps uncoded |
| | 01000 | | 9600 bps trellis |
| | 01001 | | 12000 bps |
| | 01010 | | 14400 bps |
| | 01011 | | 16800 bps |
| | 01100 | | 19200 bps |
| | 01101 | | 21600 bps |
| | 01110 | | 24000 bps |
| | 01111 | | 26400 bps |
| | 10000 | | 28800 bps |
| 7-5 | -- | -- | Reserved |

* default

S68

Reserved

DCE Independent Speed S69

The *S69* register selects the DCE independent rate operation. When *S69* is 0, DTE and DCE rates are equal and the maximum originate connect rate up to 14400 bps is determined by *S80*. When *S69* is non-zero, the maximum originate connect rate is determined by *S69*.

| Bit | Value | Command | Description |
|-----|-------|---------|----------------------------------|
| 4-0 | 00000 | %B | Use rate indicated by <i>S80</i> |
| | 00001 | %B1 | 300 bps |
| | 00011 | %B2 | 1200 bps |
| | 00100 | %B3 | 2400 bps |
| | 00101 | %B4 | 4800 bps |
| | 00111 | %B5 | 9600 bps uncoded |
| | 01000 | %B6 | 9600 bps trellis |
| | 00110 | %B7 | 7200 bps |
| | 01001 | %B8 | 12000 bps |
| | 01010 | %B9 | 14400 bps |
| | 00010 | %B10 | Reserved |
| | 01011 | %B11 | 16800 bps |
| | 01100 | %B12 | 19200 bps |
| | 01101 | %B13 | 21600 bps |
| | 01110 | %B14 | 24000 bps |
| | 01111 | %B15 | 26400 bps |
| | 10000 | %B16 | 28800 bps * |
| 7-5 | -- | -- | Reserved |

* *default*

Operating Mode S70

The *S70* register determines the protocol operating mode and action taken on an MNP link attempt failure. LAPM is assigned highest priority.

Example: With *\N7* selected the modem tries a LAPM connection first; if unsuccessful the modem tries an MNP connection; if also unsuccessful the modem connects in normal mode. Modes allowing protocol fallback are referred to as auto-reliable.

| Bit | Value | Command | Description |
|-----|-------|---------|---|
| 2-0 | 000 | \N | Normal |
| | 001 | \N1 | Direct |
| | 010 | \N2 | MNP only (reliable) |
| | 011 | \N3 | MNP or normal (auto-reliable) |
| | 100 | \N4 | LAPM only (reliable) |
| | 101 | \N5 | LAPM or normal (auto-reliable) |
| | 110 | \N6 | LAPM or MNP only (auto-reliable) |
| | 111 | \N7 | LAPM or MNP or native (auto-reliable) * |
| 3 | 0 | \M | Disable V.42 fast detect |
| | 1 | \M1 | Enable V.42 fast detect * |
| 7-4 | -- | -- | Reserved |

* default

Operating Mode Status S71

The *S71* register indicates the level of error controlling protocol. This register is for reference only.

| Bit | Value | Command | Description |
|-----|-------|---------|-----------------------------------|
| 2-0 | 000 | | Protocol not active |
| | 001 | | Protocol negotiation in progress |
| | 010 | | MNP level 2 active |
| | 011 | | MNP level 3 active |
| | 100 | | MNP level 4 active |
| | 101 | | MNP level 5 active |
| | 110 | | LAPM active |
| | 111 | | LAPM with data compression active |
| 7-3 | -- | -- | Reserved |

* default

Bit Mapped S72

| Bit | Value | Command | Description |
|-----|--------|-----------|--|
| 0 | 0 1 | \J \J1 | Disable slaved DTE/DCE (constant speed DTE on) * Disable slaved DTE/DCE (constant speed DTE on) |
| 1 | -- | -- | Reserved |
| 2 | -- | -- | Reserved |
| 3 | 0 1 | &R2 | CTS does not follow DCD CTS follows DCD |
| 6-4 | -- | -- | Reserved |
| 7 | 0 1 | | Disable autocallback * Enable autocallback |

* default

Password Timeout S73

The length of time the remote user has to enter a password before the secure V.3400 drops the call.

| Bit | Value | Command | Description |
|-----|-------|---------|-------------------------------|
| 7-0 | 0-255 | | Time in seconds (0 = disable) |

* default

Callback Delay S74

The length of time the secure modem waits to place the callback call after the remote user correctly enters a password and the call is dropped. Default is 15 seconds.

| Bit | Value | Command | Description |
|-----|-------|---------|-------------------------------|
| 7-0 | 0-255 | | Time in seconds (0 = disable) |

Callback Retry S75

The number of times the modem will attempt to place the callback call to a remote user if the first attempt is unsuccessful.

| Bit | Value | Command | Description |
|-----|-------|---------|--------------------------------------|
| 7-0 | 0-255 | | Number of attempts to place the call |

Callback Retry Delay S76

The length of time that the modem waits, after an unsuccessful attempt to connect to the remote unit at the programmed callback number, before trying to place the call again. Default is 15 seconds.

| Bit | Value | Command | Description |
|-----|-------|---------|-------------------------------|
| 7-0 | 0-255 | | Time in seconds (0 = disable) |

Lockout Threshold S77

The number of incorrect remote user password attempts that can be made before the call is dropped.

| Bit | Value | Command | Description |
|-----|-------|---------|---|
| 7-0 | 0-255 | | Number of incorrect password attempts (0 = disable) |

Autocallback Timer S78

The S78 register specifies the time in seconds that the modem waits before initiating autocallback. The default is 30 seconds.

| Bit | Value | Command | Description |
|-----|-------|---------|-------------------------------------|
| 7-0 | 0-255 | | Time in seconds before autocallback |

Break Length S79

The S79 register sets the length of the break sent to the DTE when a break signal is received. Range from 1-255 in 20 ms increments. Default is 35 (700 ms).

| Bit | Value | Command | Description |
|-----|-------|-----------|--|
| 7-0 | 0-255 | \B \Bn | Send break Set break length ($n=1-255$) |

Serial Port Speed S80

The S80 register indicates the serial port speed.

| Bit | Value | Command | Description |
|-----|-------|---------|-------------|
| 4-0 | 00001 | | 300 bps |
| | 00010 | | 600 bps |
| | 00011 | | 1200 bps |
| | 00100 | | 2400 bps |
| | 00101 | | 4800 bps |
| | 00110 | | 7200 bps * |
| | 00111 | | 9600 bps |
| | 01000 | | 12000 bps |
| | 01001 | | 14400 bps |
| | 01010 | | 16800 bps |
| | 01011 | | 19200 bps |
| | 01100 | | 21600 bps |
| | 01101 | | 24000 bps |
| | 01110 | | 26400 bps |
| | 01111 | | 28800 bps |
| | 10000 | | 38400 bps |
| | 10001 | | 57600 bps |
| | 10010 | | 115200 bps |

* default

Minimum DCE Speed S81

| Bit | Value | Command | Description |
|-----|-------|---------|------------------|
| 4-0 | 00000 | %L | Disabled |
| | 00001 | %L1 | Disabled * |
| | 00011 | %L2 | 1200 bps |
| | 00100 | %L3 | 2400 bps |
| | 00101 | %L4 | 4800 bps |
| | 00111 | %L5 | 9600 bps uncoded |
| | 01000 | %L6 | 9600 bps trellis |
| | 00110 | %L7 | 7200 bps |
| | 01001 | %L8 | 12000 bps |
| | 01010 | %L9 | 14400 bps |
| | 00010 | %L10 | Reserved |
| | 01011 | %L11 | 16800 bps |
| | 01100 | %L12 | 19200 bps |
| | 01101 | %L13 | 21600 bps |
| | 01110 | %L14 | 24000 bps |
| | 01111 | %L15 | 26400 bps |
| | 10000 | %L16 | 28800 bps |
| 7-3 | -- | -- | Reserved |

* default

S82-S87

Reserved

Modulation Type S88

| Bit | Value | Command | Description |
|-----|-------|---------|------------------------|
| 3-0 | 0000 | | Auto mode |
| | 0001 | | V.21 |
| | 0010 | | B103 |
| | 0011 | | Reserved |
| | 0100 | | B212A |
| | 0101 | | V.22 bis |
| | 0110 | | V.27 (lease line only) |
| | 0111 | | Reserved |
| | 1000 | | V.29 (lease line only) |
| | 1001 | | Reserved |
| | 1010 | | V.33 (lease line only) |
| | 1011 | | V.32 bis |
| | 1100 | | V.34 |
| 7-4 | | | Reserved |

S89-S90

Reserved

Current Modulation S91

| Bit | Value | Command | Description |
|-----|-------|---------|------------------------|
| 3-0 | 0000 | | Auto mode |
| | 0001 | | V.21 |
| | 0010 | | B103 |
| | 0011 | | Reserved |
| | 0100 | | B212A |
| | 0101 | | V.22 bis |
| | 0110 | | V.27 (lease line only) |
| | 0111 | | Reserved |
| | 1000 | | V.29 (lease line only) |
| | 1001 | | Reserved |
| | 1010 | | V.33 (lease line only) |
| | 1011 | | V.32 bis |
| | 1100 | | V.34 |
| 7-4 | | | Reserved |

S92 - S94

Reserved

V.34 Settings S95

| Bit | Value | Command | Description |
|-----|--------|---------|---|
| 0 | 0 1 | | Disable V.8 for non-V.34 answer Enable V.8 for non-V.34 answer * |
| 3-1 | -- | | Reserved |
| 4 | 0 1 | | Disable non-linear encoding Enable non-linear encoding * |
| 5 | 0 1 | | Disable pre-emphasis Enable pre-emphasis * |
| 6 | 0 1 | | Disable constellationshaping Enable constellation shaping * |
| 7 | 0 1 | | Precoding disabled Precoding enabled* |

** default***V.34 Settings S96**

| Bit | Value | Command | Description |
|-----|--------|---------|---|
| 4-0 | -- | | Reserved |
| 5 | 0 1 | | Disable asymmetric bit rates Enable asymmetric bit rates * |
| 6 | -- | | Reserved |
| 7 | 0 1 | | Disable TX power control Enable TX power control * |

** default***S97 - S100**

Reserved

Chapter 11

V.25 bis Autodialer

GENERAL

V.25 bis is an option that allows dialing functions to be controlled using synchronous data.

Select V.25 bis through the appropriate *&M* command in the AT command set (Chapter 5).

If using the LCD:

- ☐ Scroll through the menu to Main Menu 5, MODIFY CONFIGURATION.
- ☐ Advance to and enter the DTE PARAMETERS submenu.
- ☐ Select SYNC DATA.
- ☐ Advance to DIAL METHOD.
- ☐ Select either V.25 BISYNC DIALER or V.25 SDLC DIALER or V.25 ASYNC DIALER and then select either ASCII or EBCDIC character format.



Note

The modem must be configured as V.25 SDLC ASCII NRZ for use with an AS400 IBM computer.

Autodialer Command Strings and Parameters

Most command strings for the autodialer include two parts: the command itself and the parameter(s) that follow. For the purposes of this chapter, parameters can be telephone numbers or anything appropriate to V.25 bis as described in the following text. Parameters are separated by semicolons.

For example:

PRN a; nnn . . . n where a = the phone number address in memory and nnn . . . n = the phone number

The a and the nnn . . . n are both parameters.

Not all commands have parameters. For example the CIC command has no parameter.

GUIDELINES

Use the following guidelines when working with V.25 bis software:

- An indicator enclosed in less than/greater than signs represents a specific character in the appropriate character set, ASCII or EBCDIC.

<sp> - space

- Each response below is considered an individual message per V.25 bis conventions. A dial command with intermediate call progress enabled (BISYNC mode ASCII/EBCDIC character set) is illustrated:

From DTE

To DTE

<sy><sy><stx>CRN<sp>(205)555-0124<etx>

<sy><sy><stx>VAL<etb>

<sy><sy><stx>CNX<sp>@9600BPS<etx>

- Spaces in a command from the DTE are optional and ignored.
- Command strings can be upper or lower case. Responses are always upper case.
- V.25 bis commands are implemented in the following data formats:
ASYNC
BISYNC
SDLC NRZ
SDLC NRZI
in ASCII or EBCDIC

- The separator fields are data format dependent.

for ASYNC {sep} = command <CR>

BISYNC {sep} = <sy><sy><stx>command <etx>

SDLC {sep} = <Flags><Addr><ctl>command <FCS>

Where: <sy> = 16 hexadecimal

<stx> = 02 hex

<etx> = 03 hex

<etb> = 17 hex

<Flag> = 7E hex

<Addr> = FF hex

<ctl> = 13 hex (last frame), 03 hex (not last frame)

<FCS> = Frame Check Sequence

<CR> = Carriage Return

Invalid Responses Explanations

Except when stated otherwise, the following explanations for invalid *INV* responses apply:

INVCU Any transmission error (parity, framing, etc.).

INVMS Receiving too many characters for any command.

INVMS Any command followed by a semicolon ;

INVPS This message has one of three possible meanings:

- Any parameter set ending with a semicolon ;
- Any parameter set containing too many or not enough parameters; this includes
 - any command entered without parameters that requires parameters
 - any command entered with parameters that does not require parameters.
- Any parameter containing too many characters.

INVPV This message has one of three possible meanings:

- Any parameter set containing invalid characters
- Any parameter or parameter set containing no valid (only ignored) characters
- Any parameter set containing an out-of-range parameter

DIAL PARAMETERS

Table 11-1 lists and describes the parameters used in autodialing. The memory available for dialing can hold up to 40 characters. Parameters inserted for readability are not counted.

Table 11-1. V.25 bis Dial Parameters

| Character | Function |
|----------------------------------|-------------------------------------|
| 0 thru 9 | DTMF and pulse digit |
| * and # | DTMF digit |
| : | Wait for dial tone |
| W | Wait for 2nd type of dial tone |
| > | Pause for 1 second |
| = | Pause for 3 seconds |
| < | Pause for programmed delay time |
| P | Pulse dialing |
| T | Tone dialing |
| & | Flash (go on hook) for ½ second |
| ; | PARM separator |
| Space, dash, parenthesis, period | Parameters inserted for readability |

V.25 BIS COMMAND AND RESPONSE DEFINITIONS

The following sections describe the commands used with the V.25 bis autodialer and explain the responses received when each command is executed.

Dial Command CRN nn...n

The dial command is a *CRN* followed by the number to be dialed *nn...n*. The modem accepts up to 40 dial parameters, excluding the *CRN* command and any leading spaces.

Responses:

VAL Valid command received. Transmitted on receiving an error-free command with no transmission error such as a parity error. This confirmation is sent before the command is executed.

INVCU Invalid command - command unknown.
Example: TRN (205)-555-0124

INVMS Invalid command - message syntax error.
Examples: CRN;(205)-555-0124
CRN; (semicolon invalid)

INVPS Invalid command - parameter syntax error.
Examples: CRN (205)-555-0124
CRN (205)-555;0124
CRN

INVPV Invalid command - parameter value error.
Examples: CRN (205)-555-012Q
CRN

CFIET Call failure - reorder or busy.

CFIRT Call failure - timeout occurred.

CFINT Call failure - no answer back tone.

CFIDT Call failure - no dial tone.

CFIAB Call failure - ABT detected but no carrier.

INC Incoming ring detected.

Program Number Command PRN *a;nn...n*

The program number command is *PRN* followed by the one digit decimal address *a* and the number to be stored *nn . . . n*. Each address can store up to 31 dial parameters. Ignored characters in the dial number are not stored. Nine stored numbers are available at addresses 1-9.

Responses:

Same as for the *CRN* command except for call progress responses.

Intermediate Call Progress Response

The following response is given only if enabled. See Option Definition 002 below.

CNX@nnnnnBPS - where *nnnnn* is the line speed. This connect response appears after handshake completed, but before DSR is activated. This response is required if the intermediate call progress option is enabled.

Dial Stored NumberCRS *a*

The command for dialing a stored number is *CRS* followed by the one digit address *a* for the stored number to be dialed.

Responses:

Same as for the *CRN* command plus

CFINS Call failure - number not stored.

If the number is linked with other numbers, via a *PRL* command, failure responses are returned as

{sep}a;{call progress messages} . . .

where *a* is the address dialed, followed by the separator field and call progress messages (*CFI*, *etc.*).

If the call fails to connect and the number is linked with other numbers, the autodialer tries to call the next number in the list of linked numbers.

Request List of Stored Numbers RLN

The request list of stored numbers command is an *RLN*.

Responses:

INVCU Invalid command - command unknown.

Example: TLN

INVMS Invalid command - message syntax error.

Example: RLN;

If no number is stored at the specified address nothing is returned for that address. The separator {sep} is a

<etb><sy><sy><stx>LSN<sp>

sequence for BISYNC format (the last LSN string terminates with per V.25 bis). For synchronous bit-oriented operation, each LSN string is treated as an individual message per V.25 bis.

All stored numbers are sent to the DTE as

LSNa;nn...n{sep}a;nn...n...

where *a* is the stored number address and *nn...n* is the number stored.

Disregard Incoming Call DIC

The command for disregarding an incoming call does not require parameters. If no call is incoming, the command is ignored.

Responses:

VAL Valid command received. Transmitted on receiving an error-free command with no transmission error such as a parity error. This confirmation is sent before the command is executed.

INVCU Invalid command - command unknown.

Example: TIC

INVMS Invalid command - message syntax error.

Example: SIC;

Connect Incoming Call CIC

No parameters are required. If there is an incoming call, the modem immediately answers the call. If no call is incoming, the command is ignored.

Responses:

VAL Valid command received. Transmitted on receiving an error-free command with no transmission error such as a parity error. This confirmation is sent before the command is executed.

INVCU Invalid command - command unknown.

Example: TIC

INVMS Invalid command - message syntax error.

Example: SIC;

Redial Last Number CRR *n*

The *CRR n* command redials the last number a maximum of *n* times. If no parameters are present, the modem redials once. Also, the maximum number of redials, the amount of time between redials, and other parameters may vary depending on application and national requirements if outside the U. S.

Responses:

Same as for the CRS command.

Failure response is

{sep}r;{call progress messages}...

where *r* is the recall count ($1 \leq r \leq n$; 1,2...,etc.), followed by a separator field and call progress messages (*CFI XX, etc.*). If the call fails to connect, this is repeated for the specified number of times.

Link Number by Address PRL a;b

This command links the number at address *a* with the number at address *b*. The addresses are one digit decimal values. Linking numbers enables different numbers to be dialed if a call failure occurs.

Only forward linking to one other number is allowed, so address 1 can be linked to 4 to 8 to 9 etc.; however (using this example), if address 4 is dialed by a *CRS* command without connection it links forward to 8 then to 9.

If all these fail to connect, the autodialer will not back-link to address 1 unless circular linking is used. Numbers may be linked as 4 to 5 to 3; however, if address 3 is dialed, back-linking to 5 is not allowed.

If circular linking (1 to 8 to 7 to 1) is used, dialing is discontinued after the addressed number in the dial command has been dialed twice. If only one parameter follows the *PRL* command, the number at address *a* is unlinked from its forward link.

For example, if the link list 4 to 8 to 3 to 7 to 9 to 1 exists and *PRL 7* is received, 7 would be unlinked from 9, but not from 3. This would result in two link lists: 4 to 8 to 3 to 7 and 9 to 1.

Responses:

VAL Valid command received. Transmitted on receiving an error-free command with no transmission error such as a parity error. This confirmation is sent before the command is executed.

INVCU Invalid command - command unknown.

Example: TRL 1;5

INVMS Invalid command - message syntax error.

Examples: PRL;1;5
PRL;

INVPS Invalid command - parameter syntax error.

Examples: PRL 1;5;
PRL 1;0;0

PRL 1;
PRL
PRL 001;5

INVPV Invalid command - parameter value error.

Examples: PRL 1;Q
PRL Q;1
PRL 1;45 where only addresses
01 - 09 are defined

CFILD Call failure - no connection from link list.

Request List of Linked Numbers RLL

The request list of linked numbers command is an *RLL* with no parameters.

Responses:

INVCU Invalid command - command unknown.

Example: TLL

INVMS Invalid command - message syntax error.

Example: RLL;

LSL List linked numbers.

In all *LSL* examples, if no number is stored at the specified address no response is sent. The separator field for BISO SYNC is an

$\langle etb \rangle \langle sp \rangle \langle sp \rangle \langle stx \rangle LSL \langle sp \rangle$

The last *LSL* string ends with per V.25 bis. For synchronous bit oriented operation, each *LSL* string is treated as an individual message per V.25 bis. All linked numbers are sent to the DTE as

$LSLa;l\{\text{sep}\}a;l$

where a = stored address and l = link address.

Request List of Version RLV

The request list of version information command is an *RLV* with no parameters.

Responses:

INVCU Invalid command - command unknown.

Example: *TLV*

INVMS Invalid command - message syntax error.

Example: *RLV*;

LSV List version

The version information is sent to the DTE as

LSV<sp>Sbbbbbbb00sccppddr / comment field

where *bbbbbbb* is the board number, *s* is the series number, *cc* is the controller code revision, *pp* is the data pump code revision, *dd* is the board dash number, and *r* is the printed circuit board revision followed by a comment field.

MODEM OPTIONS COMMAND PRO xxx;yy;0;0...

The program options command is *PRO* followed by the starting register address (1 to 3 decimal digits), option count (1 or 2 decimal digits) and the data for each option (1 to 3 decimal digits per option). The Options section lists all available options with definitions, possible settings, and default values.

The modem must be able to accept 40 non-ignored characters besides the *PRO* command (leading zeros and semicolons are not considered ignored characters).

Responses:

VAL Valid command received. Transmitted on receiving an error-free command with no transmission error such as a parity error. This confirmation is sent before the command is executed.

INVCU Invalid command - command unknown.

Example: TRO 0;1;1

INVMS Invalid command - message syntax error.

Examples: PRO;0;1;1
PRO;

INVPS Invalid command - parameter syntax error.

Examples: PRO 0;1;0;
PRO 0;1;1;1
PRO
PRO 0;001;1

INVPV Invalid command - parameter value error.

Examples: PRO 0;1;Q
PRO Q;1;1
PRO 0;0;0
PRO 68;1;0

when option 68 is undefined for the modem.

INVPV<sp>xxx Invalid command - parameter value error.

Examples: PRO 10;5;0;0;0;2;1

This invalid message can be returned when a block of options is being changed. The conditions for this invalid response are as follows:

- An undefined option number is specified. In the above example, if option 12 is undefined for a certain modem (and no other error conditions apply) options 10 and 11 would be changed as specified in the command message. The next option to be changed would be option 12. The modem would detect that this is an undefined option, stop execution of the command, and return an INVPV012 message. Options 10 and 11 would still be changed as commanded, options 13 and 14 would be unchanged.

- An out-of-range value for a particular option is specified. In the above example, if the fourth value in the option string is undefined or out-of-range for option 13 in a certain modem (and no other error conditions apply) options 10 through 12 would be changed as specified in the command message. The next option to be changed would be option 13. The modem would then detect that the value is undefined or out-of-range for that option, stop execution of the command, and return an INVPV013 message. Options 10 through 12 would still be changed as commanded; options 13 and 14 would be unchanged.

Save Current Settings PRK

PRK saves option settings current.

Responses:

VAL Valid command received. Transmitted on receiving an error-free command with no transmission error such as a parity error. This confirmation is sent before the command is executed.

INVCU Invalid command - command unknown.

Example: *TRK*

INVMS Invalid command - message syntax error.

Examples: *PRK;0 PRK Q*

Restore Factory Settings PRP *n*

PRP n restores current option settings to factory option set *n* where *n* is a 1 digit decimal number.



Note

Restoring a factory option set other than factory option 9 disables the V.25 synchronous dialer.

If no parameter follows the command, the modem automatically selects factory option set 1.

Responses:

VAL Valid command received. Transmitted on receiving an error-free command with no transmission error such as a parity error. This confirmation is sent before the command is executed.

INVCU Invalid command - command unknown.
Example: TRP

INVMS Invalid command - message syntax error.
Examples: PRP;1 PRP Q

INVPS Invalid command - parameter syntax error.
Examples: PRP 1; PRP 1;1 PRP 001

INVPV Invalid command - parameter value error.
Example: PRP 5

where factory default 5 is not defined for the modem.
Current modem factory options are 1 - 9.

Request List of Stored Options RLO xxx; yy

The request list of stored options command is *RLO* followed by an optional 1 to 3 digit decimal address and a 1 or 2 digit decimal count. The Options section below lists all available options with definitions, possible settings, and default values.

Responses:

INVCU Invalid command - command unknown.
Example: TLO 0;1

INVMS Invalid command - message syntax error.
Examples: RLO;0;1
RLO Q;1

INVPS Invalid command - parameter syntax error.
Examples: RLO 0;1;
RLO 0;1;4
RLO 0;001

INVPV Invalid command - parameter value error.

Examples: RLO 0;Q RLO 0;0 RLO999;45

LSO List stored options.

The separator {sep} for BISYNC is an

<etb><sp><sp><stx>LSO<sp>

sequence for the sync format (the last *LSO* string terminates with per V.25 bis). For synchronous bit oriented operation, each *LSO* string is treated as an individual message per V.25 bis.

If no parameters follow, all stored options are sent to the DTE as

LSOxxx;ooo{sep}xxx;ooo...

Each value must be padded with leading zeros so that each field has three characters. Option zero would be sent as

LSO000;000

If only an address follows the command, the single requested option is sent to the DTE as

LSOxxx;ooo

If address and count follow the command, the requested count of options starting with the specified address are sent to the DTE as

LSOxxx;ooo{sep}xxx;ooo...

OPTIONS

This section lists the options for the V.25 bis autodialer. These options can be changed using the *PRO* command or listed using the *RLO* command.

- 000-001: Not applicable
- 002: Intermediate call progress messages
 - 0 - Disable
 - 1 - Enable
 - Default value = 0
- 003: Blind dial
 - 0 - Disable
 - 1 - Enable
 - Default value = 0
- 004-006: Not applicable
- 007: Long space disconnect
 - 0 - Disable
 - 1 - Enable
 - Default value = 1
- 008-019: Not applicable
- 020: Programmable / permissive operation
 - 0 - Permissive
 - 1 - Programmable
 - Default value = 0
- 021-022: Not applicable
- 023-049: Reserved for future use
- 050: Mode
 - 0 - 2-wire dial-up operation (PSTN)
 - 1 - 4-wire leased line operation
 - 2 - 2-wire leased line operation
 - Default value = 0

- 051: Primary transmit / receive rate
(See Rate Select section below.)
Default value = 54 (28800 bps)
000-006: Not applicable
007: 1200 bps
008: 2400 bps
009-033: Not applicable
034: 4800 bps
035: 9600 bps uncoded
036: 9600 bps
037-045: Not applicable
046: 7200 bps
047: 12,000 bps
048: 14,400 bps
049: 16,800 bps
050: 19,200 bps
051: 21,600 bps
052: 24,000 bps
053: 26,400 bps
054: 28,800 bps
055-999: Reserved for future use
- 052-054: Not applicable
- 055: Transmit clock
0 - Internal
1 - External
2 - Receive (slave)
Default value = 0
- 056: Leased line transmit level -
Transmit level (0 through -30 dBm)
(- {decimal} dBm)
Default value = 0
- 057-062: Not applicable
- 063: Autoanswer
0 - Disable
1 - Enable (answer after 1 to 255 rings)
Default value = 1

- 064: Line current disconnect
0 - Off
1 - Short (8 ms)
2 - Long (90 ms)
Default value = 2
- 065-075: Not applicable
- 076: Speaker control
0 - Off
1 - On
2 - N/A
3 - N/A
4 - On until CD
5 - N/A
6 - Off while dialing
Default value = 4
- 077: Speaker volume
0 - Low
1 - Medium
2 - High
Default value = 1
- 078-084: Not applicable
- 085: Constant carrier RTS/CTS delay
0 to 250 ms
Must be set in increments of 10 ms:
10, 20, 30 . . . 250
Default value = 0
- 086: Not applicable
- 087: DTR dropout timer
0 to 255 in 10 ms increments
DTR must turn off for this length of
time to be recognized.
Default value = 5 (50 ms)
- 088: Not applicable

- 089: Pause in dial string
 0 - Invalid
 1 to 255 seconds
 Default value = 2
- 090: Carriage return character
 (13 decimal is ASCII and EBCDIC default)
- 091: Line feed character
 (10 decimal is ASCII default;
 37 decimal is EBCDIC default)
- 092: Guard tone
 0 = None
 1 = 550 Hz
 2 = 1800 Hz
 Default value = 0
- 093: Carrier detect delay
 0 - Off 1 to 255 in increments of 10 ms
 Default value = 6 (60 ms)
- 094: Loss of carrier disconnect
 0 - Off 1 to 255 in 100 ms increments
 Default value = 14 (1.4 sec)
- 095: DTR dial address
 Stored telephone number address to dial
 on DTR off-to-on transition
 Default value = 1
- 096: DTR dial
 0 - Disable
 1 - Enable
 2 - N/A
 Default value = 0
- 097: Not applicable

| | |
|----------|--|
| 098: | Call timeout 0 - Off 1-255 sec Default value = 30 sec |
| 099-102: | Not applicable |
| 103: | Signal quality retrain 0 - Disable 1 - Send training sequence on poor quality Default value = 1 |
| 104-106: | Not applicable |
| 107-110: | Reserved for future use |
| 111: | Modulation mode 000: Automode 001: V.21 002: B103 003: Reserved 004: Reserved 005: V.22 006: V.22 bis 007: V.27 ter 008: Reserved 009: V.29 010: Reserved 011: V.33 012: V.32 bis 013: V.34 (V.Fast) |
| 112 | V.34 Select Threshold 000: Low 001: Medium 002: High |
| 113 | V.34 Asymmetric bit rates 000: Disabled 001: Enabled |

114 - 899: Reserved for future use

900-902: Not applicable

903: Bilateral loop
 0 - Disable
 1 - Enable
 Default value = 0

If enabled and a test is commanded, bilateral loop is defined as follows:

| Test Commanded | Bilateral Loop |
|-----------------------|-----------------------|
|-----------------------|-----------------------|

| | |
|--------|--------|
| Loop 1 | Loop 2 |
| Loop 2 | Loop 1 |
| Loop 3 | Loop 4 |
| Loop 4 | Loop 3 |

Loop definitions are per CCITT V.54.

904: DTE commanded remote digital loopback
 0 - Disable
 1 - Enable
 Default value = 0

905: DTE commanded local analog loopback
 0 - Disable
 1 - Enable
 Default value = 0

906: Remote commanded test
 0 - Disable
 1 - Enable
 Default value = 1

907: Test timer
 0 - Until DTR drops
 TTT - 1 to 255 sec
 Default value = 0

908: Not applicable

909-999: Reserved for future use

Chapter 12

Maintenance



Warning

Disconnect power before performing maintenance. Although dangerous voltage levels are not exposed, disconnecting power will ensure an electric shock hazard is not present.

GENERAL

The modem contains no internal electronic components that can be serviced or replaced by the user. Repairs should not be attempted by the user.

FUSE

If a fuse fails, replace it with one of equal rating. Repeated failure indicates a more serious problem.

MAINTENANCE

The modem provides maintenance free service. Periodically it is necessary to remove dust that has collected on internal components. Remove dust with a soft bristle brush and low pressure air or vacuum.

Before attempting diagnostic tests, check that all connectors and plugs are firmly inserted. The test procedures will identify the faulty component in a bad communications link.

If the unit appears faulty, contact the Motorola Field Service Department at 1-800-221-4380 for service and assistance. Do not return the unit without prior instructions.

Appendix A

Specifications

Size

| | |
|-------------|-------------------------|
| Width | 7.0 inches (17.78 cm) |
| Depth | 10.5 inches (26.67 cm) |
| Height | 2.25 inches (5.72 cm) |
| Weight | 2 lbs. 13 oz. (1.28 kg) |
| Front Panel | 32 ASCII character LCD |

Environmental Conditions

Temperature:

Operation +32° F to +122° F
(0° C to +50° C)

Storage -40° F to +158° F
(-40° C to +70° C)

Humidity: 0 to 95% relative humidity: noncondensing

Power Requirements

The modem can be ordered for operation with one of three power input options.

Voltage: 115 Vac $\pm 10\%$; 50-60 Hz,
230 Vac $\pm 10\%$; 50-60 Hz, or
12 to 60 Vdc

Power consumption: 14 watts

Telephone Line

Balanced 600 ohm type 3002 or equivalent 16 dB nominal loss,
frequency translation up to ± 10 Hz

Digital Interface

Conforms to EIA-232D and CCITT V.24

Modem Data Rates

300, 1200, 2400, 4800, 7200, 9600, 12000, 14400, 16800, 19200, 21600, 24000, 26400, and 28800 bps.

Fax Rates

14400, 12000, 9600, 7200, 4800, 2400, 1200, and 300 bps

Modulations

V.34, V.32, V.22, V.21, V.27 bis, V.29, Bell 103, V.17, V.33, V.22 bis, V.32 bis

Fax Modulation

| Modulation | Speed |
|-------------------|----------------------------|
| V.21 channel 2 | 300 bps |
| V.27 ter | 2400 bps |
| V.27 ter | 4800 bps |
| V.29 | 7200 bps |
| V.17 | 7200 bps |
| V.17 | 7200 bps with short train |
| V.29 | 9600 bps |
| V.17 | 9600 bps |
| V.17 | 9600 bps with short train |
| V.17 | 12000 bps |
| V.17 | 12000 bps with short train |
| V.17 | 14400 bps |
| V.17 | 14400 bps with short train |

Internal Transmit Clock Frequency

Selected bit rate $\pm 0.01\%$

External Transmit Clock Frequency

Selected bit rate $\pm 0.01\%$

Transmit Output Level

0 to -30 dBm, selectable; PSTN operation is programmable or permissive.

Operation

- 4-wire, full-duplex, leased (private) line;
- 2-wire, full-duplex, leased (private) line or PSTN

Carrier Detect Level

Dynamic to -43 dBm

Telco Connection

8-pin modular jack, dial and private lines

Testing

511 PN pattern (per V.52) V.54 remote loopback control

Line Equalization

Automatic adaptive

RTS/CTS Delay

From 0 ± 2 ms to 90 ± 2 ms, user selectable in 10 ms increments
(The default is 0 ms.)

Link Layer Protocols

V.42/V.42 bis error correction and compression protocol
MNP levels 2-5 error correction and compression protocol

Appendix B

Phone Jack Descriptions

LINE PIN FUNCTIONS

The 8-pin LINE jack connects to the PSTN dial-up lines. Pin Functions are:

| Pin | Function |
|-------|---|
| 1, 2 | Not used |
| 3 MI | Switch hook on exclusion key telephone not used in some systems |
| 4 R | Rings side of telephone line |
| 5 T | Tip side of telephone line |
| 6 MIC | Switch hook on exclusion key telephone |
| 7 PR | Data jack program position |
| 8 PC | To data jack program resistor |

AUX PIN FUNCTIONS

The 8-pin AUX jack allows a standard telephone or a leased line to be connected to the modem. The pin functions for this jack are:

| Pin | Function |
|------|--|
| 1, 2 | Transmit pair - 4-wire leased line or Tx and Rx for 2-wire leased line |
| 4, 5 | Ring and tip (respectively) of telephone line for a telephone |
| 7, 8 | Receive pair - 4-wire leased line |

Appendix C Strap Options

STRAP OPTION SELECTION

Modem configuration is controlled by front panel pushbuttons and the LCD, AT or V.25 bis commands, and hardware option straps located on the pc board. Normally straps do not have to be changed. If a change is required, remove the modem cover to access the option straps. The strap diagrams on the following pages indicate the factory settings.

Removing the Cover



Warning

Disconnect ac power before removing the cover. Although dangerous voltage levels are not exposed, disconnecting power ensures an electrical shock hazard is not present.

Place the unit on its side on a flat surface. To disengage the lock prong from the lock clip insert a medium size flat screwdriver blade in one of the latch slots. DO NOT PUSH the screwdriver but lightly pry the handle away from the unit as illustrated in Figure C-1. Assist removal by pushing the cover from the chassis with your fingers on the unit rear edges. Repeat this procedure with the remaining three latch slots.

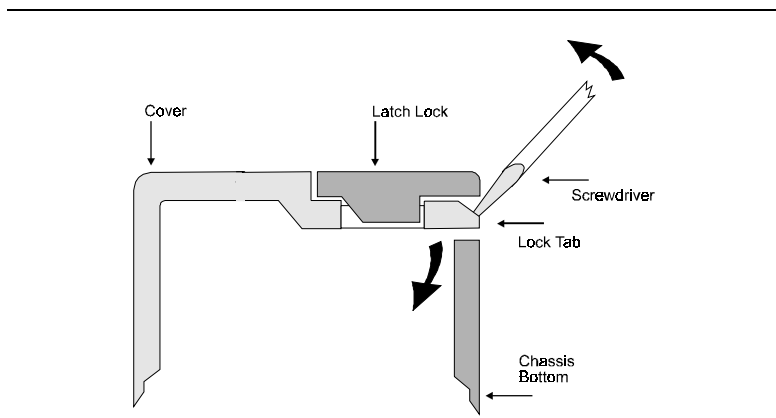


Figure C-1 Cover Removal

Figure C-2 shows strap locations and Figure C-3 shows typical strap configurations.

To replace the cover align the lock clips, rear guide grooves, and front lock tabs. Press the cover in place until the lock clips engage the lock prongs.

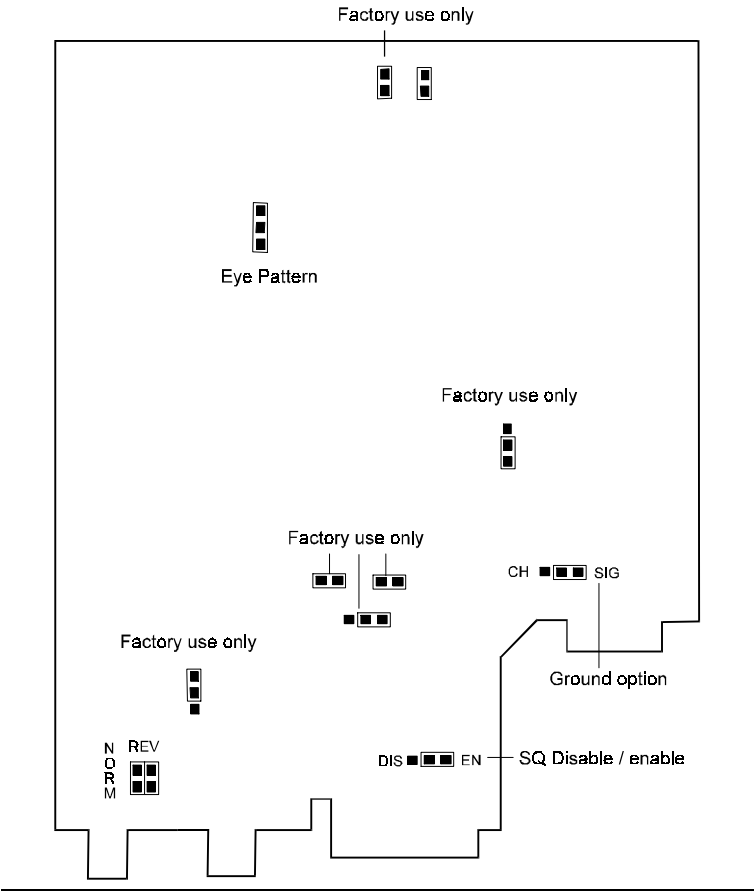


Figure C-2 Strap Locations

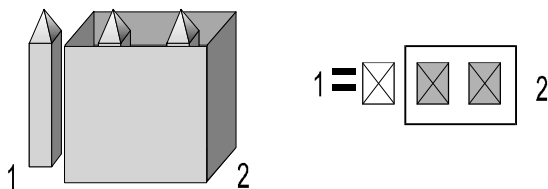
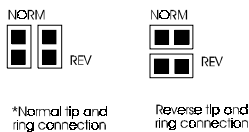


Figure C-3 Typical Strap Configuration

HARDWARE STRAPS

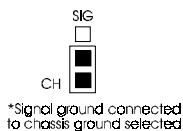
Tip and Ring Polarity

Some telephones are tip and ring polarity sensitive. If a dial tone is detected after dialing, reverse these two straps.



Ground Option Strap

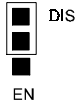
Signal ground is normally connected to chassis ground. If interference exists, isolate signal ground from chassis ground.



** factory setting*

QM Disable Option

When enabled, the Quality Monitor (QM) output is connected to the EIA-232 (pin 11) interface. Disabling it disconnects the QM output. Refer to Chapter 4 and Table 2-1 for more QM information.



*QM output (disabled) not connected to EIA-232 interface

QM Normal/Inverted

This strap selects normal or inverted QM output.



*QM output is normal
(QM signal going high indicates poor signal quality)

* factory setting

Appendix D

Fault Isolation Procedure

FAULT ISOLATION PROCEDURE

This diagnostic test procedure and the indicator lights built into the modem allow a rapid check of the terminals, modems, and telephone line interface. This procedure can be used to verify normal system operation and to isolate faulty equipment in case of failure.

Ensure the units are turned on and remote loops are enabled at both sites before starting the fault isolation procedure.



Note

In some cases the observer must distinguish between rapid LED blinking and steady on in tests.

Telephone Interface

1. Connect the modem to the dial-in line via the LINE jack on the back panel.
2. If the dial line is installed with a standard permissive data jack, connect a standard telephone to the AUX jack on the back panel of the modem and use the standard telephone procedure.

If the dial line is installed with an exclusion key telephone wired for data set controls the line, connect an exclusion key telephone to the RJ36X jack and use the exclusion key phone procedure.

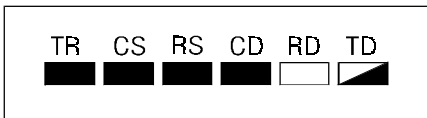
Standard Phone

1. Configure the modem to V.34 28800 IDLE mode by pressing the TALK/ DATA button, and then lift the receiver. No dial tone is heard. Press the TALK/DATA button to display V.34 IDLE and wait for dial tone.
2. Dial out; the phone should operate normally.

MODEM AND TELEPHONE LINE CHECK

Step 1

- a. Configure the modem for LOCAL ANALOG LOOP WITH TEST PATTERN. This terminates the local modem telephone lines into 600 ohms and connects the local modem transmit output amplifier back to its own receiver through the AGC. Transmit input data from the terminal is inhibited and is substituted with a V.52 test pattern.
- b. This test checks operation of the local modem modulator and demodulator circuitry and should be attempted at both local and remote sites if operators are available.
- c. When random errors are present, the TEST PATTERN ERRORS display counts receive errors.
- d. If the circuitry is working properly, the front panel indicators show the following:

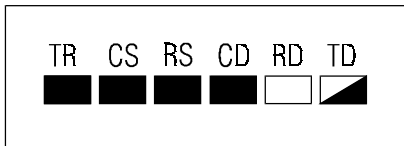


- e. Configure the modem for LOCAL ANALOG LOOP to switch the transmitter back to its normal data input.
- f. If the transmit data input is in a mark hold condition, both the TD and RD indicators should remain off.
- g. If the transmit data input is in a space hold condition, both the TD and RD indicators should come on. All other indicators should remain the same.
- h. If the indicators are correct, the modem is probably operating correctly.
- i. If the preceding tests were not successful, call Technical Services.

Step 2

This step determines the performance of the local and remote modems and the telephone circuits. It also determines each modem's ability to receive a transmitted signal from the other site, properly equalize and decode the signal and then loop this regenerated signal into the transmitter for transmission back to the other modem. This test applies to both leased line and dial line operation.

- a. Configure the local modem for **REMOTE DIGITAL LOOP WITH TEST PATTERN**. This signals the remote modem to go into digital loop. The remote modem receives and then retransmits the data back to the local mode. If the digital bilateral loop is enabled at the remote, the remote DTE is looped back to itself.
- b. An alternative to the above procedure is to request the operator at the remote modem to configure his modem for **LOCAL DIGITAL LOOP**. Configure the local modem for **TEST PATTERN**. The remote modem receives and retransmits the data back to the local modem.
- c. The **TEST PATTERN ERRORS** display will count received errors.
- d. At the local modem, the indicators should be:



- e. To further test the modem and communications link, reverse the system loopback. First exit the existing loopback test. Reverse the roles of the local and remote modems and repeat step two.



Note

If the bilateral digital loop is enabled at the local modem, the DTE interface is looped to itself and permits the DTE to check the interface circuitry as well as itself.

Appendix E

Command Index and Defaults

GENERAL

This reference guide provides asynchronous command characters and their meanings. Pages listed provide initial information on the commands.

S-registers are listed as a cross reference.

Table E-1. AT Commands

| Command | Page | S-Reg | Description |
|---------|--------------|---------|---------------------------------------|
| AT | 5-3 | | Attention code - command prefix |
| A/ | 5-5 | | Repeat last command |
| +++ | 5-21 | S2, S12 | Escape sequence (pause, + + +, pause) |
| A | 5-17 | | Answer |
| D | 5-13, 9-4 | | Dial |
| T | 5-14 | S14 | Tone dial * |
| P | | S14 | Pulse dial |
| , | | S8 | Long pause (2 sec or S8 value) |
| W | 5-15 | S7 | Wait for 2nd dial tone (S7 value) |
| ! | | | Flash switchboard |
| R | | | Switch to answer mode after dialing |
| ; | | | Return to command mode after dialing |
| @ | 5-16 | | Wait for 5 seconds of silence |
| Sn | | | Dial stored command line |
| E | 5-21 | S14 | Local character echo off |
| E1 | | | Local character echo on * |
| F | 5-22 | | Not supported - returns ERROR |
| F1 | | | Disables online character echo |

*factory default



Note

The * in the command is part of the command; the * in the description indicates the default.

Table E-1. AT Commands (Continued)

| Command | Page | S-Reg | Description |
|---------|------|-------|---|
| H | 5-22 | | Hang up † |
| H1 | | | Forces modem off hook † |
| H2 | | S14 | Set H command to V.32 * † |
| H3 | | | Set H command to fast † |
| I | 5-23 | | Request product code |
| I1 | | | Request EPROM CRC value |
| I3 | | | Request product version |
| I4 | | | Request capability code |
| I5 | | | Disconnect reason |
| L or L1 | | | Speaker volume low |
| L2 | | | Speaker volume medium* |
| L3 | | | Speaker volume high |
| M | | S22 | Speaker off |
| M1 | | | Speaker off when carrier is present |
| M2 | | | Speaker always on |
| M3 | | | Speaker off when dialing and carrier is present |
| O | 5-24 | | Restore data mode (after escape) † |
| O1 | | | Retrain and restores data mode (after escape) † |
| Q | 5-7 | S14 | Response displays on * |
| Q1 | | | Response displays off |
| Q2 | | | Response displays on in originate mode only |
| Sn? | 10-3 | | Read value in register <i>n</i> (decimal) |
| Sn?^ | | | Read value in register <i>n</i> (hexadecimal) |
| Sn=v | | | Set <i>v</i> (value) in register <i>n</i> (decimal) |
| Sn=v^ | | | Set <i>v</i> (value) in register <i>n</i> (hexadecimal) |
| Sn.#=v | 10-4 | | Set single bit value in register <i>n</i> , # = bit position 0-7, <i>v</i> = bit value 1 or 0 |
| V | 5-6 | S14 | Response codes |
| V1 | | | Response messages * |

* factory default

† cannot be executed from remote configuration mode

Table E-1. AT Commands (Continued)

| Command | Page | S-Reg | Description |
|-----------|------|-------|---|
| W | 5-7 | | Negotiation display disabled * |
| W1 | | | Negotiation display enabled |
| W2 | | | Displays DCE link rate |
| X | | S22 | CONNECT (code 1), for all speeds, no dial tone or busy signal detection |
| X1 | | | Appropriate connect codes for rate, no dial tone detection |
| X2 | | | Wait for dial tone (appropriate connect codes) |
| X3 | | | Detect busy signal (appropriate connect codes) |
| X4 | | | Wait for dial tone, detect busy signal (appropriate connect codes) * |
| Y | 5-24 | S21 | Long space disconnect disabled |
| Y1 | | | Long space disconnect enabled * |
| Z | 5-41 | | Reset to user option set #1 † |
| Z1 | | | Reset to user option set #2 † |
| &C | 5-18 | S21 | DCD always on * |
| &C1 | | | DCD on while carrier is present |
| &C2 | | | DCD off 5 seconds after disconnect |
| &C3 | | | DCD follows remote RTS |
| &D | 5-19 | S21 | DTR ignored * |
| &D1 | | | DTR recalls command mode |
| &D2 | | | DTR disconnects |
| &D3 | | | DTR disconnects and resets modem to stored configuration |
| &F or &F1 | 5-40 | | Restore factory configuration 1 * † |
| &F2 | | | Restore factory configuration 2 † |
| &F3 | | | Restore factory configuration 3 † |
| &F4 | | | Restore factory configuration 4 † |
| &F5 | | | Restore factory configuration 5 † |
| &F6 | | | Restore factory configuration 6 † |

* factory default

† cannot be executed from remote configuration mode

Table E-1. AT Commands (Continued)

| Command | Page | S-Reg | Description |
|---------|--------------|-------|---|
| &F7 | 5-40 | | Restore factory configuration 7 † |
| &F8 | | | Restore factory configuration 8 † |
| &F9 | | | Restore factory configuration 9 † |
| &G | 5-24 | S23 | No guard tone * |
| &G1 | | | 550 Hz tone |
| &G2 | | | 1800 Hz tone |
| &L | 5-36 | S27 | Dial line * † |
| &L1 | | S32 | Leased line 2-wire † |
| &L2 | | | Leased line 4-wire † |
| &M | 5-25 | S27 | Asynchronous dial / asynchronous data * |
| &M1 | | | Asynchronous dial / synchronous data |
| &M2 | | | Dials stored number when DTR off / on transition is detected / synchronous data |
| &M3 | | | Manual dial / synchronous data |
| &M4 | | S30 | V.25 bis autodialer with BISYNC protocol / synchronous data |
| &M5 | | | V.25 bis autodialer with SDLC protocol / synchronous data |
| &M6 | | | V.25 bis async dial / sync data |
| &P | 5-26 | S22 | 39/61 pulse make / break ratio * |
| &P1 | | | 33/67 pulse make / break ratio |
| &R | 5-20 | S21 | CTS normal operating state |
| &R1 | | | CTS forced on * |
| &R2 | | S72 | CTS follows DCD |
| &R9 | | | CTS equals RTS |
| &S | 5-18 | S21 | DSR always on * |
| &S1 | | | DSR on when ready to accept data |
| &S2 | | | DSR off for 5 seconds after disconnect |
| &S3 | | | DSR follows off hook (OH) |
| &T | 5-44, 7-2 | | Terminate current test † |
| &T1 | 7-3 | | Initiate analog loopback † |

* factory default

† cannot be executed from remote configuration mode

Table E-1. AT Commands (Continued)

| Command | Page | S-Reg | Description |
|---------|------|-------|--|
| &T3 | 7-5 | | Initiate digital loopback † |
| &T4 | 7-6 | S23 | Grant remote commanded digital loopback * † |
| &T5 | | S23 | Denies remote commanded digital loopback † |
| &T6 | 7-7 | | Initiate remote digital loopback † |
| &T7 | | | Initiate self test remote digital loopback † |
| &T8 | 7-4 | | Initiate self test analog loopback † |
| &V | 5-41 | | View configuration profiles * |
| &V1 | | | Display received signal status |
| &V2 | | | Display active profile |
| &W | 5-39 | | Store current configuration to user option set #1 * |
| &W1 | | | Store current configuration to user option set #2 |
| &X | 5-26 | S27 | Internal clock * |
| &X1 | | | External clock |
| &X2 | | | Receive clock |
| &Y | 5-40 | | Powerup with user option set #1 * |
| &Y1 | | | Powerup with user option set #2 |
| &Y? | | | Display powerup option set |
| &Zn | 5-41 | | Store dial string |
| %A | 6-5 | S64 | Disable auto-reliable fallback character * |
| %An | | | Set auto-reliable fallback character to n (n = ASCII 1-127) † |
| %B | 5-28 | S69 | Use DTE speed |
| %B1 | | | 300 bps max |
| %B2 | | | 1200 bps max |
| %B3 | | | 2400 bps max |
| %B4 | | | 4800 bps max |
| %B5 | | | 9600 bps uncoded max |
| %B6 | | | 9600 bps max |
| %B7 | | | 7200 bps max |

* factory default

† cannot be executed from remote configuration mode

Table E-1. AT Commands (Continued)

| Command | Page | S-Reg | Description |
|---------|------|-------|--|
| %B8 | 5-28 | | 12000 bps max |
| %B9 | | | 14400 bps max |
| %B10 | | | Reserved |
| %B11 | | | 16800 bps max |
| %B12 | | | 19200 bps max |
| %B13 | | | 21600 bps max |
| %B14 | | | 24000 bps max |
| %B15 | | | 26400 bps max |
| %B16 | | | 28800 bps max * |
| %C | 6-11 | S56 | Compression disabled |
| %C1 | | | Compression enabled on transmit and receive data * |
| %C2 | | | Compression enabled on transmit data only |
| %C3 | | | Compression enabled on receive data only |
| %D | 6-4 | S62 | Disable disconnect buffer delay * |
| %Dn | | | Set disconnect buffer delay in seconds n ($n = 1-255$) |
| %E | 5-29 | S60 | Disable auto retrain |
| %E1 | | | Enable auto retrain * |
| %L | | S81 | Disabled |
| %L1 | | | Disabled * |
| %L2 | | | 1200 bps min |
| %L3 | | | 2400 bps min |
| %L4 | | | 4800 bps min |
| %L5 | | | 9600 bps uncoded min |
| %L6 | | | 9600 bps min |
| %L7 | | | 7200 bps min |
| %L8 | | | 12000 bps min |
| %L9 | | | 14400 bps min |
| %L10 | | | Reserved |
| %L11 | | | 16800 bps min |
| %L12 | | | 19200 bps min |

* ~~features~~ ~~be executed~~ from remote configuration mode

Table E-1. AT Commands (Continued)

| Command | Page | S-Reg | Description |
|------------|------|-------|--|
| %L13 | 5-29 | | 21600 bps min |
| %L14 | | | 24000 bps min |
| %L15 | | | 26400 bps min |
| %L16 | | | 28800 bps min |
| %P= | 5-43 | | Sets remote configuration security code to value entered after equal sign (0-99999999) |
| %P=D | | | Disabled |
| %P? | | | Displays remote configuration security code of local modem |
| %P=(blank) | | | Clears the security code* |
| %R | 5-30 | S53 | Disable automatic rate adaption * |
| %R1 | | | Enable automatic rate adaption low BER |
| %R2 | | | Enable automatic rate adaption medium BER |
| %R3 | | | Enable automatic rate adaption using high BER |
| %T | 7-8 | | Transmit test pattern † |
| %T= | 5-44 | | Followed by a remote configuration security code, establishes remote configuration † |
| %V | 5-31 | | Display product revision level |
| %Z | 5-32 | | Permissive (RJ11) * † |
| %Z1 | | | Programmable (RJ45) † |
| \A | 6-10 | S63 | Maximum block size of 64 characters |
| \A1 | | | Maximum block size of 128 characters |
| \A2 | | | Maximum block size of 192 characters |
| \A3 | | | Maximum block size of 256 characters * |
| \B | 6-11 | S79 | Transmit a break signal * |
| \Bn | | | Sets break length in 20 ms increments, n=1-255, default is 35 (700 ms) |
| \C | | S60 | Disable auto-reliable buffer * |

* factory default

† cannot be executed from remote configuration mode

Table E-1. AT Commands (Continued)

| Command | Page | S-Reg | Description |
|---------|------|-------|---|
| \C1 | 6-11 | | Buffer data for 4 seconds or 200 characters |
| \G | 6-8 | S54 | Disable modem port flow control * |
| \G1 | | | Enable modem port XON/XOFF flow control |
| \J | 6-4 | S72 | Disable slaved DTE/DCE speed * (constant speed DTE on) |
| \J1 | | | Enable slaved DTE/DCE speed (constant speed DTE off) |
| \Kn | 6-8 | S59 | Selects action when encountering a break |
| \K | | | Break option 0 |
| \K1 | | | Break option 1 |
| \K2 | | | Break option 2 |
| \K3 | | | Break option 3 |
| \K4 | | | Break option 4 |
| \K5 | | | Break option 5 * |
| \M | 6-4 | S70 | V.42 fast detect data sequence disabled |
| \M1 | | | V.42 fast detect data sequence enabled * |
| \N | 6-5 | S70 | Normal mode |
| \N1 | | | Direct mode |
| \N2 | | | MNP only |
| \N3 | | | MNP or normal |
| \N4 | | | LAPM only |
| \N5 | | | LAPM with normal fallback |
| \N6 | | | LAPM with MNP fallback |
| \N7 | | | LAPM with MNP and normal fallback * |
| \Q | 6-6 | S54 | Disable DTE flow control |
| \Q1 | | | Enable DTE XON/XOFF flow control * |
| \Q2 | | | Enable CTS flow control to the DTE |
| \Q3 | | | Enables bilateral CTS/RTS flow control |
| \Q4 | | | Disable DCE flow control |
| \Q5 | | | Enable DCE XON/XOFF flow control * |
| \Q6 | | | Enable CTS flow control to the DTE |

* ~~factory default~~ *factory default* executed from remote configuration mode

Table E-1. AT Commands (Continued)

| Command | Page | S-Reg | Description |
|---------|------|-------|---|
| \Q7 | 6-6 | | Enable CTS flow control to the DTE |
| \R | 5-19 | S60 | Ring indicate, blinks for ring and remains on for duration of call |
| \R1 | | | Ring indicate, blinks for ring and turns off when call is answered * |
| \T | 6-10 | S58 | Disable inactivity timer * |
| \Tn | | | Set inactivity timer to n ($n = 1-255$ minutes) |
| \V | 5-7 | S60 | Disable protocol result codes * |
| \V1 | | | Enable protocol result codes |
| \X | 6-7 | S54 | No XON/XOFF characters to remote DCE * |
| \X1 | | | Pass XON/XOFF characters to remote DCE |
| *AUn | 5-16 | | Dial number stored at location n upon transition of DTR in command mode ($n = 1-9$) |
| *AS | 5-27 | | Disable V.34 asymmetric bit rate |
| *AS1 | | | Enable V.34 asymmetric bit rate |
| *CNx,n | 5-41 | | Store phone number n in location x ($x = 1-9$) |
| *DA | 5-32 | | Switches modem to talk mode * † |
| *DA1 | | | Switches modem to data mode † |
| *DB | 5-37 | | Manual dial backup operation * |
| *DB1 | | | Automatic dial backup operation |
| *DG | 7-9 | S34 | Disables bilateral digital loop * |
| *DG1 | | | Enables bilateral digital loop |
| *FB | 5-21 | S29 | Ignore pin 23 * |
| *FB1 | | | Pin 23 transition causes DTE speed fallback |
| *FT | 5-32 | S29 | Disable fast train * |
| *FT1 | | | Enable fast train |
| *IC | 5-32 | | Disregard incoming call |
| *LA | 7-9 | S34 | Ignore pin 18 * |
| *LA1 | | | DTE commanded LAL enabled |
| *LB | 5-37 | | Return to leased line from dial backup † |
| *LC | 5-33 | S32 | Line current disconnect disabled |

* factory default

† cannot be executed from remote configuration mode

Table E-1. AT Commands (Continued)

| Command | Page | S-Reg | Description |
|---------|------|-------|---------------------------------------|
| *LC1 | 5-33 | | Short (8 ms) line current disconnect |
| *LC2 | | | Long (90 ms) line current disconnect* |
| *LD | 5-37 | | Manual dial backup * |
| *MM | 5-27 | | Automode (modulation) |
| *MM1 | | | V.21 |
| *MM2 | | | Bell 103J |
| *MM3 | | | Reserved |
| *MM4 | | | Bell 212A |
| *MM5 | | | V.22 bis |
| *MM6 | | | V.27 bis 4-wire leased only |
| *MM7 | | | Reserved |
| *MM8 | | | V.29 4-wire leased only |
| *MM9 | | | Reserved |
| *MM10 | | | V.33 4-wire leased only |
| *MM11 | | | V.32 bis |
| *MM12 | | | V.34 |
| *ND | 5-41 | | Displays the nine stored numbers |
| *NT | 5-33 | S29 | AT command set disabled |
| *NT1 | | | AT command set enabled * |
| *OR | 5-37 | S14 | Originate * |
| *OR1 | | | Forced answer |
| *RC | 5-9 | S57 | 15 - 4800 bps, 18 - 9600 bps * |
| *RC1 | | | 11 - 4800 bps, 12 - 9600 bps |
| *RD | 7-9 | S34 | Ignore pin 21 * |
| *RD1 | | | DTE commanded RDL enabled |
| *RO | 5-42 | S29 | Retain options at disconnect * |
| *RO1 | | | Restore options at disconnect |
| *RR | 5-31 | | Rate negotiate to 2400 † |
| *RR1 | | | Rate negotiate to 4800 † |
| *RR2 | | | Rate negotiate to 7200 † |
| *RR3 | | | Rate negotiate to 9600 † |

* factory default

† cannot be reset from remote configuration mode

Table E-1. AT Commands (Continued)

| Command | Page | S-Reg | Description |
|---------|------|-------|--|
| *RR4 | 5-31 | | Rate negotiate to 12000 † |
| *RR5 | | | Rate negotiate to 14400 † |
| *RR6 | | | Rate negotiate to 16800 † |
| *RR7 | | | Rate negotiate to 19200 † |
| *RR8 | | | Rate negotiate to 21600 † |
| *RR9 | | | Rate negotiate to 24000 † |
| *RR10 | | | Rate negotiate to 26400 † |
| *RR11 | | | Rate negotiate to 28800 † |
| *TDn | 5-33 | | Sets dial transmit level -10 to -30 dBm |
| *TH | 5-26 | | Low rate selection threshold (10^{-6} BER) |
| *TH1 | | | Medium rate selection threshold (10^{-4} BER) |
| *TH2 | | | High rate selection threshold (10^{-2} BER)* |
| *TLn | 5-37 | S52 | Sets leased line transmit level to n where n is a number between 0 and 30 corresponding to 0 to -30 db † |
| \$H | 5-31 | | Online quick reference |
| \$V | | | Display product serial number |

*factory default

† cannot be executed from remote configuration mode

Table E-2. Low Security Commands

| Command | Page | S-Reg | Description |
|---------|------|-------|--|
| \$S=x | 8-3 | | Sets an empty password location to x |
| \$C=x,y | | | Changes either password where x represents the old password and y is the new one |
| \$C=x,- | | | Deletes password x from memory |
| \$DR | | | Reset security |
| \$D=x | | | Disables security where x is either password |
| \$D? | 8-4 | | Displays the current status of security |
| \$E=x | | | Enables security where x is either password |
| \$E? | | | Displays the current security status |

Table E-3. High Security Commands

| Command | Page | S-Reg | Description |
|-------------|------|-------|---|
| \$Cn=m | 8-8 | | Set user callback number. <i>n</i> = user number and <i>m</i> = the callback number |
| \$D | 8-7 | | Disable security * |
| \$E? | 8-10 | | Display current security status (enabled/disabled) |
| \$EH=pw | 8-6 | | Enable security (<i>pw</i> = superuser password) † |
| \$F=pw\$pw | 8-10 | | Reinitialize security * |
| \$IBn | 8-11 | | Display user information for a block of up to ten valid users (<i>n</i> = first user number) |
| \$In | | | Display user information (<i>n</i> = user number) |
| \$Ln=m | 8-8 | | Set security level for the user specified by <i>n</i> (<i>m</i> = security level) |
| \$M | 8-9 | | Display illegal attempts information |
| \$M* | | | Reset illegal attempts registers and restore all suspended users to normal status |
| \$Mn | | | Reset illegal attempts registers and restore suspended user <i>n</i> to normal status |
| \$Pn=pw\$pw | 8-7 | | Set user password; <i>n</i> = user number and new password (<i>n</i> = 0 for superuser <i>pw</i> = password) |
| \$Rn | 8-10 | | Remove a user (<i>n</i> = user number) |
| \$S? | | | Display current user status (superuser / user) |
| \$W0 | 8-9 | | Disable user changes (password and callback number) † |
| \$W1 | | | Enable user changes (password and callback number) † |
| \$W2 | 8-10 | | Enable remote superuser † |
| \$W? | 8-9 | | Display user changes remote superuser option status |
| \$ | 8-11 | | Local logoff |
| \$n=pw | | | Local logon (<i>n</i> = user number and <i>pw</i> = password) |
| \$S=pw | | | Request to enter superuser status (<i>pw</i> = password) |

* Only local superuser can execute command

† Only allowed in idle mode and local DTE

Table E-4. Fax Commands

| Fax Command | Page | Description |
|--------------------|-------------|--|
| +FCLASS=0 | 9-6 | Service Class 0 (data modem) * ‡ |
| +FCLASS=1 | | Service Class 1 (fax modem) ‡ |
| +FCLASS? | | Display current Service Class setting ‡ |
| +FCLASS=? | | Display available Service Class settings ‡ |
| +FAA | 9-10 | Enables fax auto answer function |

* default

‡ Cannot executed from remote configuration

Extended (Class 1) Commands Valid only in fax mode:

Table E-5. Commands Valid only in Fax Mode

| Command | Page | Description |
|----------------|-------------|--|
| +FTS=(Time) | 9-6 | Stop transmission and pause (10 ms intervals, 0-255) * |
| +FRS=(Time) | 9-7 | Waits for silence (10 ms intervals, 0-255) * |
| +FTM=(MOD) | 9-8 | Transmit data with (MOD) carrier * |
| +FRM=(MOD) | | Receive data with (MOD) carrier * |
| +FTH=(MOD) | | Transmit HDLC data with (MOD) carrier * |
| +FRH=(MOD) | 9-9 | Receive HDLC data with (MOD) carrier * |

where the (MOD) parameter can be one of the following values:0.

| Value | Modulation | Speed |
|--------------|-------------------|----------------------------|
| 3 | V.21 channel 2 | 300 bps |
| 24 | V.27 ter | 2400 bps |
| 38 | V.27 ter | 4800 bps |
| 72 | V.29 | 7200 bps |
| 73 | V.17 | 7200 bps |
| 74 | V.17 | 7200 bps with short train |
| 96 | V.29 | 9600 bps |
| 97 | V.17 | 9600 bps |
| 98 | V.17 | 9600 bps with short train |
| 121 | V.17 | 12000 bps |
| 122 | V.17 | 12000 bps with short train |
| 145 | V.17 | 14400 bps |
| 146 | V.17 | 14400 bps with short train |

* cannot be executed from remote configuration

Table E-5. Commands Valid only in Fax Mode (Continued)

| Command | Page | Description |
|----------|------|--|
| +FTx=? | 9-9 | Check range for values supported where <i>x</i> may be <i>M</i> , <i>S</i> , or <i>H</i> . If <i>x</i> is <i>M</i> or <i>H</i> , the modem returns 3, 24, 48, 72, 73, 96, 97, 98, 121, 122, 145, 146. If <i>x</i> is <i>S</i> , the modem returns 0-255. |
| +FRx=? | | |
| +FCERROR | | Carrier different from specified in +FRM or +FRH |

STATUS REGISTERS

Table E-6. Status Registers

| S-Reg | RO/ RW | Page | Function | Default |
|-------|-----------|-------|----------------------------|--------------|
| S0 | RW | 10-5 | Ring to answer | 1 |
| S1 | RO | | Ring count | |
| S2 | RW | | Escape sequence character | 43 (+) |
| S3 | RW | | End-of-line character | 13 (CR) |
| S4 | RW | 10-6 | Line feed character | 10 (LF) |
| S5 | RW | | Backspace character | 8 (BS) |
| S6 | RW | | Pause before blind dialing | 2 (2 sec) |
| S7 | RW | | Pause for carrier | 30 (30 sec) |
| S8 | RW | | Pause for comma | 2 (2 sec) |
| S9 | RW | | Carrier validation | 6 (0.6 sec) |
| S10 | RW | 10-7 | Loss carrier delay time | 14 (1.4 sec) |
| S11 | RO | | DTMF tone duration | |
| S12 | RW | | Escape sequence pause | 50 (1 sec) |
| S14 | RW | 10-8 | Bit mapped | |
| S16 | RO | 10-9 | System tests | |
| S18 | RW | | Test timer | 0 |
| S21 | RW | 10-10 | Bit mapped | |
| S22 | RW | 10-11 | Bit mapped | |
| S23 | RW | | Bit mapped | |
| S25 | RW | 10-12 | DTR recognition time | 5 (0.5 sec) |
| S26 | RW | | RTS/CTS delay | 0 |
| S27 | RW | | Bit mapped | |

RO=Read only RW=Read or write

Table E-6. Status Registers (Continued)

| S-Reg | RO/ RW | Page | Function | Default |
|--------------|-------------------|-------------|--------------------------------|----------------|
| S28 | RW | 10-13 | Lookback timer | 15 min |
| S29 | RW | | Bit mapped | |
| S30 | RW | 10-14 | V.25 mode selection | |
| S32 | RW | | Bit mapped | |
| S34 | RW | 10-15 | Bit mapped | |
| S35 | RW | | Default dial number | |
| S39 | RW | | Bit mapped | |
| S44 | RW | 10-16 | DTE XON character | |
| S45 | RW | | DTE XOFF character | |
| S49 | RW | | DCE XON character | |
| S50 | RW | | DCE XOFF character | |
| S52 | RW | | Lease transmit level | 0 |
| S53 | RW | 10-17 | Bit mapped | |
| S54 | RW | | Bit mapped | 0 |
| S56 | RW | 10-18 | V.42 compression | |
| S57 | RW | | Bit mapped | 0 |
| S58 | RW | | Inactivity timer | 0 |
| S59 | RW | 10-19 | MNP break control | 5 |
| S60 | RW | | Bit mapped | |
| S61 | RO | 10-20 | DTE character size, parity | 6 |
| S62 | RW | | Disconnect buffer delay | 0 |
| S63 | RW | | Maximum protocol block size | 255 |
| S64 | RW | 10-21 | Auto-reliable character | 0 |
| S67 | RO | | Link speed status | |
| S69 | RW | 10-22 | Maximum DCE speed | |
| S70 | RW | | Protocol operating mode | 1 |
| S71 | RO | 10-23 | Protocol operating mode status | |
| S72 | RW | 10-24 | Bit mapped | |
| S73 | RW | | Password timeout security | |
| S74 | RW | | Callback delay | |
| S75 | RW | 10-25 | Callback retry | |

RO=Read only RW=Read or write

Table E-6. Status Registers (Continued)

| S-Reg | RO/ RW | Page | Function | Default |
|-------|-----------|-------|----------------------|---------|
| S76 | RW | 10-25 | Callback retry delay | |
| S77 | RW | | Lockout threshold | |
| S78 | RW | | Autocallback timer | 30 |
| S79 | RW | | Break length | 35 |
| S80 | RO | 10-26 | Serial port speed | 6 |
| S81 | RW | 10-27 | Minimum DCE rate | 1 |
| S82 | RW | | Bit mapped | |
| S88 | RW | 10-28 | Modulation type | |
| S91 | RW | | Current modulation | |
| S95 | RW | 10-29 | V.34 settings | |
| S96 | RW | | V.34 settings | |

RO=Read only RW=Read or write

V.25 bis DIALER COMMANDS

Table E-7. V.25 bis Dialer Commands

| Synchronous Command | Page | Description |
|---------------------|------|---|
| CIC | 11-8 | Connect incoming call command |
| CRN <i>nn...n</i> | 11-5 | Dial command (<i>nn...n</i> = number to be dialed) |
| 0 - 9 | | DTMF and pulse digit |
| * # | | DTMF digit |
| : | | Wait for dial tone |
| W | | Wait for second type of dial tone |
| > | | Pause for 1 second |
| = | | Pause for 3 seconds |
| < | | Pause for programmed delay time |
| P | | Pulse dial |
| T | | Tone dial |
| & | | Flash (go on hook) for 1/2 second |
| ; | | Parameter separator |

Table E-7. V.25 bis Dialer Commands (Continued)

| Synchronous Command | Page | Description |
|----------------------------------|-------------|---|
| Space, dash, parenthesis, period | | Clarity characters |
| CRR <i>n</i> | 11-8 | Redial the last number a maximum of <i>n</i> times |
| CRS <i>a</i> | 11-6 | Dial stored number command (<i>a</i> = address) |
| DIC | 11-7 | Disregard incoming call command |
| PRK | 11-13 | Save current option settings |
| PRL <i>a;b</i> | 11-9 | Link number at address <i>a</i> with number at address <i>b</i> |
| PRN <i>a; nm...n</i> | 11-6 | Program number command (<i>nm...n</i> = number to be dialed, <i>a</i> = address) |
| PRO <i>xxx;yy;0;0...</i> | 11-11 | Program options command (<i>xxx</i> = register address, <i>yy</i> = option count) |
| PRP <i>n</i> | 11-13 | Restores current option settings to the factory defaults in default bank <i>n</i> (1-9) |
| RLL | 11-10 | Request list of linked numbers command |
| RLN | 11-7 | Request list of stored numbers command |
| RLO <i>xxx;yy</i> | 11-14 | Request list of stored options command (<i>xxx</i> = register address, <i>yy</i> = option count) |
| RLV | 11-11 | Request list of version information command |

Table E-8. Response Messages

| Response Message | Meaning |
|-------------------------|---|
| CFIAB | Call failure - answer back tone but no connection |
| CFIDT | Call failure - no dial tone |
| CFIET | Call failure - reorder or busy |
| CFILD | Call failure - link list complete |
| CFINS | Call failure - number not stored |
| CFINT | Call failure - no answer back tone, no ringback |
| CFIRT | Call failure - timeout occurred |
| CNX @ 28800 bps | Intermediate call progress - connection made at 28800 |

Table E-8. Response Messages (Continued)

| Response Message | Meaning |
|-------------------------|---|
| CNX @ 26400 bps | Intermediate call progress - connection made at 26400 |
| CNX @ 24000 bps | Intermediate call progress - connection made at 24000 |
| CNX @ 21600 bps | Intermediate call progress - connection made at 21600 |
| CNX @ 19200 bps | Intermediate call progress - connection made at 19200 |
| CNX @ 16800 bps | Intermediate call progress - connection made at 16800 |
| CNX @ 14400 bps | Intermediate call progress - connection made at 14400 |
| CNX @ 12000 bps | Intermediate call progress - connection made at 12000 |
| CNX @ 9600 bps | Intermediate call progress - connection made at 9600 |
| CNX @ 7200 bps | Intermediate call progress - connection made at 7200 |
| CNX @ 4800 bps | Intermediate call progress - connection made at 4800 |
| CNX @ 2400 bps | Intermediate call progress - connection made at 2400 |
| CNX @ 1200 bps | Intermediate call progress - connection made at 1200 |
| INC | Incoming ring detected |
| INVCU | Invalid command - command unknown |
| INVMS | Invalid command - message syntax error |
| INVPS | Invalid command - parameter syntax error |
| INVPV | Invalid command - parameter value error |
| VAL | Valid command received |

FACTORY OPTION SETS

FACTORY OPTION SET #1

(Asynchronous Dial-up with V.42bis Protocol) (AT&F or AT&F1)

- **MODEM OPTIONS**

DCE rate - 28800
Modulation automode
V.34 rate threshold high
V.34 asymmetric rate enabled
Normal originate
Fast train disabled
Auto retrain enabled
Sq auto rate disabled
Transmit clock internal
Dial line
Jack type RJ11 (permissive)
Line current disconnect long
Long space disconnect enabled
V.22 guard tone disabled

- **PROTOCOL OPTIONS**

LAPM protocol enabled
MNP protocol enabled
Protocol fallback enabled
Data compression normal
Constant DTE speed
DTE flow control XON/XOFF
DCE flow control XON/XOFF
XON/XOFF pass through disabled
Inactivity timer off
Break control 5
V.42 fast detect enabled

- **SPEAKER OPTIONS**

Volume medium
On until carrier detect

- **TEST OPTIONS**

Bilateral analog loop disabled
Bilateral digital loop disabled
DTE local test disabled
DTE remote test disabled
Remote commanded test enabled
Test timeout off

- **DIAL LINE OPTIONS**

Tone dial
Auto dial #1
Wait for dial tone
Wait delay 2 seconds
Pause delay 2 seconds
Call timeout 30 seconds
Answer on 1 ring
801 V.32 timeout long
Autocallback disabled

- **DTE OPTIONS**

Async data
DTE rate - 9600
8 bit, No parity
Async controlled dialer
AT command set enabled
Ignores DTR
DSR forced high
DCD forced high
CTS forced high
DTE fallback disabled
Options retained at disconnect

FACTORY OPTION SET # 2 **(Asynchronous Dial-up without V.42bis Protocol) (AT&F2)**

• MODEM OPTIONS

DCE rate - 28800
Modulation automode
V.34 rate threshold low *
V.34 asymmetric rate enabled
Normal originate
Fast train disabled
Auto retrain enabled
Sq auto rate disabled
Transmit clock internal
Dial line
Jack type RJ11 (permissive)
Line current disconnect long
Long space disconnect enabled
V.22 guard tone disabled

• PROTOCOL OPTIONS

LAPM protocol disabled *
MNP protocol disabled *
Normal buffer mode *
Constant DTE speed
DTE flow control disabled *
DCE flow control disabled *
XON/XOFF pass through disabled *
Inactivity timer off
Break control 0 *
V.42 fast detect disabled *

• SPEAKER OPTIONS

Volume medium
On until carrier detect

• TEST OPTIONS

Bilateral analog loop disabled
Bilateral digital loop disabled
DTE local test disabled
DTE remote test disabled
Remote commanded test enabled
Test timeout off

• DIAL LINE OPTIONS

Tone dial
Auto dial #1
Wait for dial tone
Wait delay 2 seconds
Pause delay 2 seconds
Call timeout 30 seconds
Answer on 1 ring
801 V.32 timeout long
Autocallback disabled

• DTE OPTIONS

Async data
DTE rate - 9600
8 bit, No parity
Async controlled dialer
AT command set enabled
Ignores DTR
DSR forced high
DCD forced high
CTS follows RTS *
DTE fallback disabled
Options retained at disconnect

* Indicates variation from factory option set #1

FACTORY OPTION SET #3 (Synchronous Dial-up) (AT&F3)

• MODEM OPTIONS

DCE rate - 28800
Modulation automode
V.34 rate threshold low *
V.34 asymmetric rate disabled *
Normal originate
Fast train disabled
Auto retrain enabled
Sq auto rate disabled
Transmit clock internal
Dial line
Jack type RJ11 (permissive)
Line current disconnect long
Long space disconnect enabled
V.22 guard tone disabled

• PROTOCOL OPTIONS

LAPM protocol disabled *
MNP protocol disabled *
Direct buffer mode *
DTE flow control disabled *
DCE flow control disabled *
XON/XOFF pass through disabled
Inactivity timer off
Break control 0 *
V.42 fast detect disabled *

• SPEAKER OPTIONS

Volume medium
On until carrier detect

• TEST OPTIONS

Bilateral analog loop disabled
Bilateral digital loop disabled
DTE local test disabled
DTE remote test disabled
Remote commanded test enabled
Test timeout off

• DIAL LINE OPTIONS

Tone dial
Auto dial #1
Wait for dial tone
Wait delay 2 seconds
Pause delay 2 seconds
Call timeout 30 seconds
Answer on 1 ring
801 V.32 timeout long
Autocallback disabled

• DTE OPTIONS

Sync data *
Dial method manual *
AT command set disabled *
DTR disconnects *
DSR normal *
DCD normal *
CTS follows RTS *
RTS/CTS delay 0 ms *
DTE fallback disabled
Options retained at disconnect

** Indicates variation from factory option set #1*

FACTORY OPTION SET # 4

(Synchronous 4-wire Leased Line) (AT&F4)

• MODEM OPTIONS

DCE rate - 28800
V.34 modulation *
V.34 rate threshold low *
V.34 asymmetric rate enabled
Normal originate
Fast train disabled
Auto retrain enabled
Sq auto rate disabled
Transmit clock internal
Leased line *
4-wire *
Transmit level - 0 dBm *
Dial backup manual *
Lookback timer - 15 min *
Jack type RJ11 (permissive)
Line current disconnect long
Long space disconnect enabled
V.22 guard tone disabled

• PROTOCOL OPTIONS

LAPM protocol disabled *
MNP protocol disabled *
Direct buffer mode *
DTE flow control disabled *
DCE flow control disabled *
XON/XOFF pass through disabled
Inactivity timer off
Break control 0 *
V.42 fast detect disabled *

• SPEAKER OPTIONS

Volume medium
On until carrier detect

• TEST OPTIONS

Bilateral analog loop enabled *
Bilateral digital loop enabled *
DTE local test disabled
DTE remote test disabled
Remote commanded test enabled
Test timeout off

• DIAL LINE OPTIONS

Tone dial
Auto dial #1
Wait for dial tone
Wait delay 2 seconds
Pause delay 2 seconds
Call timeout 60 seconds *
Answer on 1 ring
801 V.32 timeout long
Autocallback disabled

• DTE OPTIONS

Sync data *
AT command set disabled *
Ignores DTR
DSR normal *
DCD normal *
CTS follows RTS *
RTS/CTS delay 0 ms *
DTE fallback disabled
Options retained at disconnect

** Indicates variation from factory option set #1*

FACTORY OPTION SET #5

(Asynchronous 4-wire Leased Line with V.42bis Protocol) (AT&F5)

• MODEM OPTIONS

DCE rate - 28800
V.34 modulation *
V.34 rate threshold high
V.34 asymmetric rate enabled
Normal originate
Fast train disabled
Auto retrain enabled
Sq auto rate disabled
Transmit clock internal
Leased line, 4-wire *
Transmit level - 0 dBm *
Dial backup manual *
Lookback timer - 15 min *
Jack type RJ11 (permissive)
Line current disconnect long
Long space disconnect enabled
V.22 guard tone disabled

• PROTOCOL OPTIONS

LAPM protocol enabled
MNP protocol disabled *
Protocol fallback disabled *
Data compression normal
Constant DTE speed
DTE flow control XON/XOFF
DCE flow control XON/XOFF
XON/XOFF pass through disabled
Inactivity timer off
Break control 5
V.42 fast detect enabled

• SPEAKER OPTIONS

Volume medium
On until carrier detect

• TEST OPTIONS

Bilateral analog loop disabled
Bilateral digital loop disabled
DTE local test disabled
DTE remote test disabled
Remote commanded test enabled
Test timeout off

• DIAL LINE OPTIONS

Tone dial
Auto dial #1
Wait for dial tone
Wait delay 2 seconds
Pause delay 2 seconds
Call timeout 30 seconds
Answer on 1 ring
801 V.32 timeout long
Autocallback disabled

• DTE OPTIONS

Async data
DTE rate - 9600
8 bit, No parity
AT command set enabled
Ignores DTR
DSR forced high
DCD forced high
CTS forced high
DTE fallback disabled
Options retained at disconnect

** Indicates variation from factory option set #1*

FACTORY OPTION SET # 6

(Asynchronous 4-wire Leased Line without V.42 Bis Protocol) (AT&F6)

• MODEM OPTIONS

DCE rate - 28800
V.34 modulation *
V.34 rate threshold low *
V.34 asymmetric rate enabled
Normal originate
Fast train disabled
Auto retrain enabled
Sq auto rate disabled
Transmit clock internal
Leased line, 4-wire *
Transmit level - 0 dBm*
Dial backup manual *
Lookback timer - 15 min *
Jack type RJ11 (permissive)
Line current disconnect long
Long space disconnect enabled
V.22 guard tone disabled

• PROTOCOL OPTIONS

LAPM protocol disabled *
MNP protocol disabled *
Normal buffer mode

Constant DTE speed
DTE flow control disabled *
DCE flow control disabled *
XON/XOFF pass through disabled
Inactivity timer off
Break control 0 *
V.42 fast detect enabled

• SPEAKER OPTIONS

Volume medium
On until carrier detect

• TEST OPTIONS

Bilateral analog loop disabled
Bilateral digital loop disabled
DTE local test disabled
DTE remote test disabled
Remote commanded test enabled
Test timeout off

• DIAL LINE OPTIONS

Tone dial
Auto dial #1
Wait for dial tone
Wait delay 2 seconds
Pause delay 2 seconds
Call timeout 30 seconds
Answer on 1 ring
801 V.32 timeout long
Autocallback disabled

• DTE OPTIONS

Async data
DTE rate - 9600
8 bit, No parity
AT command set enabled
Ignores DTR
DSR forced high
DCD forced high
CTS forced high
DTE fallback disabled
Options retained at disconnect

** Indicates variation from factory option set #1*

FACTORY OPTION SET # 7

(Synchronous 2-wire Leased Line Normal Originate) (AT&F7)

• MODEM OPTIONS

DCE rate - 28800
V.34 modulation *
V.34 rate threshold low *
V.34 asymmetric rate disabled *
Normal originate
Fast train disabled
Auto retrain enabled
Sq auto rate disabled
Transmit clock internal
Leased line, 2-wire *
Transmit level - 0 dBm*
Dial backup manual *
Lookback timer - 15 min *
Jack type RJ11 (permissive)
Line current disconnect long
Long space disconnect enabled
V.22 guard tone disabled

• PROTOCOL OPTIONS

LAPM protocol disabled *
MNP protocol disabled *
Direct buffer mode *
DTE flow control disabled *
DCE flow control disabled *
XON/XOFF pass through disabled
Inactivity timer off
Break control 0 *
V.42 fast detect disabled *

• SPEAKER OPTIONS

Volume medium
On until carrier detect

• TEST OPTIONS

Bilateral analog loop disabled
Bilateral digital loop disabled
DTE local test disabled
DTE remote test disabled
Remote commanded test enabled
Test timeout off

• DIAL LINE OPTIONS

Tone dial
Auto dial #1
Wait for dial tone
Wait delay 2 seconds
Pause delay 2 seconds
Call timeout 60 seconds *
Answer on 1 ring
801 V.32 timeout long
Autocallback disabled

• DTE OPTIONS

Sync data *
AT command set disabled *
Ignores DTR
DSR normal *
DCD normal *
CTS follows RTS *
RTS/CTS delay 0 ms *
DTE fallback disabled
Options retained at disconnect

** Indicates variation from factory option set #1*

FACTORY OPTION SET # 8

(Synchronous 2-wire Leased Line Forced Answer) (AT&F8)

• MODEM OPTIONS

DCE rate - 28800
V.34 modulation *
V.34 rate threshold low *
V.34 asymmetric rate disabled *
Forced answer *
Fast train disabled
Auto retrain enabled
Sq auto rate disabled
Transmit clock internal
Leased line, 2-wire *
Transmit level - 0 dBm*
Dial backup manual *
Lookback timer - 15 min *
Jack type RJ11 (permissive)
Line current disconnect long
Long space disconnect enabled
V.22 guard tone disabled

• PROTOCOL OPTIONS

LAPM protocol disabled *
MNP protocol disabled *
Direct mode *
DTE flow control disabled *
DCE flow control disabled *
XON/XOFF pass through disabled
Inactivity timer off
Break control 0 *
V.42 fast detect disabled *

• SPEAKER OPTIONS

Volume medium
On until carrier detect

• TEST OPTIONS

Bilateral analog loop enabled *
Bilateral digital loop enabled *
DTE local test disabled
DTE remote test disabled
Remote commanded test enabled
Test timeout off

• DIAL LINE OPTIONS

Tone dial
Auto dial #1
Wait for dial tone
Wait delay 2 seconds
Pause delay 2 seconds
Call timeout 60 seconds *
Answer on 1 ring
801 V.32 timeout long
Autocallback disabled

• DTE OPTIONS

Sync data *
AT command set disabled *
Ignores DTR
DSR normal *
DCD normal *
CTS follows RTS *
RTS/CST delay 0 ms *
DTE fallback disabled
Options retained at disconnect

* Indicates variation from factory option set #1

FACTORY OPTION SET #9 (Synchronous V.25bis Dialer) (AT&F9)

• MODEM OPTIONS

DCE rate - 28800
Modulation automode
V.34 rate threshold low *
V.34 asymmetric rate disabled *
Normal originate
Fast train disabled
Auto retrain enabled
Sq auto rate disabled
Transmit clock internal
Dial line
Jack type RJ11 (permissive)
Line current disconnect long
Long space disconnect enabled
V.22 guard tone disabled

• PROTOCOL OPTIONS

LAPM protocol disabled *
MNP protocol disabled *
Direct mode *
DTE flow control disabled *
DCE flow control disabled *
XON/XOFF pass through disabled
Inactivity timer off
Break control 0 *
V.42 fast detect disabled *

• SPEAKER OPTIONS

Volume medium
On until carrier detect

• TEST OPTIONS

Bilateral analog loop disabled
Bilateral digital loop disabled
DTE local test disabled
DTE remote test disabled
Remote commanded test enabled
Test timeout off

• DIAL LINE OPTIONS

Tone dial
Auto dial #1
Wait for dial tone
Wait delay 2 seconds
Pause delay 2 seconds
Call timeout 30 seconds
Answer on 1 ring
801 V.32 timeout long
Autocallback disabled

• DTE OPTIONS

Sync data *
V.25 SDLC dialer *
Character type ASCII
SDLC data format NRZ *
DTR disconnect *
DSR normal *
DCD normal *
CTS follows RTS *
RTS/CTS delay 0 ms *
RTS/CTS delay 0 ms *
DTE fallback disabled
Options retained at disconnect

** Indicates variation from factory option set #1*

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